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ANALYSIS OF NAVAL AIR SYSTEMS COMMAND WIDE-AREA NETWORK PROTOTYPE IMPLEMENTATION

by

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Changes in computer and communications technology over the past decade made wide-area networking (WAN) the most convenient, inexpensive, and effective method for geographically dispersed people to exchange information. One organization which is capitalizing on the benefits of WAN connectivity is the Naval Air Systems Command (NAVAIR). Using information technology as a strategic enabler for managing organizational change, Vice Admiral William C. Bowes, Commander, Naval Air Systems Command, championed the idea of a Naval Air Systems Command Wide Area Network (NAVWAN).

The ultimate goal of the NAVWAN is to enable people at different sites throughout NAVAIR to directly communicate. Initially, the functional requirements are electronic mail, file transfer, and directory services throughout NAVAIR. To assist NAVAIR in the development of a NAVWAN implementation prototype, the initial response of users at NAS Miramar was assessed.

The purpose of this study is to demonstrate how a stakeholder analysis; weaknesses, opportunities, threats, and strengths assessment; diffusion of innovation survey; and technological change management theory can be used to analyze the factors that will influence the success of the NAVWAN implementation. Analysis of these factors are the basis for several prescribed critical and managerial recommendations. These recommendations can be used to further refine the implementation process and foster evolutionary development of NAVWAN far into the future.

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ANALYSIS OF NAVAL AIR SYSTEMS COMMAND WIDE-AREA NETWORK PROTOTYPE IMPLEMENTATION

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ABSTRACT

Changes in computer and communications technology over the past decade made wide-area networking (WAN) the most convenient, inexpensive, and effective method for geographically dispersed people to exchange information. One organization which is capitalizing on the benefits of WAN connectivity is the Naval Air Systems Command (NAVAIR). Using information technology as a strategic enabler for managing organizational change, Vice Admiral William C. Bowes, Commander, Naval Air Systems Command, championed the idea of a Naval Air Systems Command Wide Area Network (NAVWAN).

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I. INTRODUCTION

Changes in computer and communications technology over the past decade made wide area networking the most convenient, inexpensive, and effective method for geographically dispersed people to exchange information. By increasing the speed and volume of communication, the wide area network (WAN) will facilitate the growth of global information exchange networks. Connections in the global environment allow individuals to instantantly locate and share information with colleagues around the world. It is especially useful for personal, professional, and research exchanges between remote people with a common interest or purpose.

In comparison to other forms of communication, wide area networking is extremely flexible with respect to format, time, and location. The presentation of the material can be in many formats including text, graphics, spreadsheets, or diagrams. The sender and receiver can also conveniently create and access the information without regard for time zones or the availability of the receiver. Once connected to a wide area network, a user can send information to any location with an accessible address. Therefore, WAN connectivity is fast becoming an essential communication tool for individuals and organizations.

One organization which is capitalizing on the benefits of WAN connectivity is the Naval Air Systems Command (NAVAIR). As a result of their reorganization in April 1992, NAVAIR is now a competency aligned organization with integrated program teams located at twenty two different sites across the country. In order for the teams to work jointly on projects, they must efficiently communicate. Using information technology as a strategic enabler for managing organizational change, Vice Admiral William C. Bowes,

Commander, Naval Air Systems Command, championed the idea of a Naval Air Systems Command Wide Area Network (NAVWAN).

The ultimate goal of the NAVWAN is to enable people at different sites throughout NAVAIR to directly communicate. Initially, the requirement was for electronic mail, file transfer, and directory services throughout NAVAIR. A NAVWAN team was established to perform the systems analysis, design and implementation of the NAVWAN. Using existing architectures, bridges, and gateways, the members of the NAVWAN team created a plan for connectivity throughout NAVAIR from the headquarters to the organizational level.

In order to evaluate the implementation, the NAVWAN team determined several organizational level prototype sites. At each prototype site, a demonstration of the implementation of the NAVWAN is planned in order to validate the functionality of the NAVWAN. One of the sites chosen is the Miramar Naval Air Station, Miramar, California. As a member of this team, I assessed the implications of the NAVWAN implementation at this site. The scope of implications include the extent to which the NAVWAN will meet the information technology (IT) functional requirements, increase user productivity, and support mission accomplishment. Barriers to the NAVWAN implementation and methods to overcome these barriers are also included. The results of my findings are addressed in this thesis and will be considered in the implementation of future NAVWAN sites.

A. OBJECTIVE AND RESEARCH QUESTIONS

The purpose of this thesis is to analyze the implications of the NAVWAN implementation at the Miramar Naval Air Station. These implications address both the potentiality and limitations of the NAVWAN to meet the stakeholder's network communication requirements. Key stakeholders and their goals are identified, mapped, and analyzed to determine significant factors to be considered in developing an effective implementation strategy. The research questions are as follows:

1. Who are the primary stakeholders and what are their functional requirements?
2. What are the predicted responses of the stakeholder users to the NAVWAN?
3. What are the weaknesses, opportunities, threats and strengths of the NAVWAN implementation?
4. What factors should be considered for the most effective implementation of the NAVWAN?

B. ORGANIZATION OF THE THESIS

This thesis is divided into six chapters. The introduction is followed by a literature review that delineates the primary thesis research and analysis resources. Chapter III describes the methodology used to conduct and analyze the stakeholder audit. A short survey on the characteristics of the NAVWAN that will facilitate implementation is also included. The results of the stakeholder audit and the diffusion of innovation characteristics are addressed in Chapter IV. Analysis of these results is provided in Chapter V. Based on this analysis, Chapter VI addresses the implications of technological change, prescribes

specific recommendations for management consideration, and suggests opportunities for further research.

II. LITERATURE REVIEW

In order to formulate a research methodology for this thesis, a literature review of relevant topics was conducted. The literature review focused on the research methods and paradigms used to conduct the research, evaluate the findings, analyze the results, and prescribe recommendations.

A. STAKEHOLDER FRAMEWORK AND ANALYSIS

In 1984, Doctor R. Edward Freeman wrote a book titled *Strategic Management: A Stakeholder Approach*. This book is sole reference for this section of the literature review. Freeman defines a stakeholder as "an individual or group who can affect or is affected by the achievement of an organization's mission." In management theory, this term could describe an array of people and groups. From a corporate perspective, stakeholders would include the board of directors, shareholders, customers, employees, suppliers, special interest groups, regulatory agencies and anyone else who could be affected by the achievement of an organization's mission or affect the achievement of that mission.

Stakeholder management is a concept that predicts that an organization that deliberately manages its relationships with the stakeholders will be more effective in mission accomplishment. Failure to successfully manage these relationships, can result in negative influences by stakeholders. These negative influences may cause an organization to fail to achieve its goals. Consequently, stakeholder management has become a

common management practice for many organizations who need the support of stakeholder groups to achieve their mission.

The initial step in stakeholder management is to identify the stakeholders. These stakeholders can be categorized by two manners, internal and external. Internal stakeholders are participants or contributors to the internal operations of the organization. In a corporate setting, these include shareholders, employees and members of the board of directors. Internal stakeholders are normally included within the bounds of the organization and its processes. External stakeholders are beyond the bounds of the organization, but still can have a significant affect on the organization. From a corporate perspective, this would include the media, special interest groups and regulatory agencies.

Sometimes, the internal and external categories are not clear and will be determined by the issue at stake. For example, a union steward would be an internal stakeholder if the issue is profits and affects the entire organization. The same union steward is an external stakeholder if the issue is health benefits which are determined by management but directly affect the union employees.

Once the stakeholders are identified, it is helpful to map them. This map can be derived from assessment of an organization's environment and its' structure. These graphical presentations of organizational stakeholders should present a clear picture of the number, identity, and relationship of the stakeholders.

After stakeholders are determined, an organization can assess what the stakeholders have at stake in their relationship with the organization. By determining the interests and concerns of the stakeholders, the organization can better manage each stakeholder relationship. If an organization is concerned about the way their actions affect a specific stakeholder, they must act to address their interests. For example, an environmental special interest group with significant political clout could affect the governmental regulation of a particular organization if that organization did not practice environmental consciousness in accordance with the special interest groups's expectation or views.

A **stakeholder audit** represents a deliberate analysis by an organization of stakeholders and their stakes in particular organizationally relevant issues. Basically, the stakeholder audit is a listing of stakeholders and their stakes in the organization. This audit is a reference tool for the organization making decisions. Before decision makers evaluate options, they should consult the stakeholder audit and assess the interest of any potential stakeholders in the outcome of that decision. Further, they should determine the amount of influence each stakeholder has on the success or failure of that decision.

Stakeholders with a positive influence should be employed to facilitate the success of the decision involved. If a stakeholder has significant negative influence, this affect must be carefully managed to avoid failure. By selecting options that yield the greatest level of support from key stakeholders, management can achieve higher levels of success

in their endeavors. Without the support of stakeholders, these endeavors may be undermined.

Stakeholder analysis is performed by weighing the influence of stakeholders on a particular course of action. Through keen awareness of the stakeholders and their interests, managers can predict the response of the stakeholders to management decisions. By selecting the option that provides the greatest weighted benefit for stakeholders, management can capitalize on their aggregate support. This benefit is weighted, because some stakeholders have more influence than others. The most significant consideration for management is the amount of influence each stakeholder has on the outcome Therefore, one stakeholder with tremendous influence may affect the outcome more than several stakeholders with little influence.

In a project that incorporates a number of organizations, the stakeholder map, audit, and analysis can be employed. From the stakeholder map, project managers can assess key stakeholders and their relationship with an organization. The stakeholder audit clearly indicates the interests of the key stakeholders. The stakeholder analysis is performed by applying audit techniques to determine stakeholder proponents and opponents to a particular course of action. Based on the analysis of the stakeholder audit, managers can determine a course of action that will capitalize on the greatest stakeholder support.

The stakeholder analysis also assists in the management of negative stakeholder influences because the analysis predicts the response and the causes. Knowing that there

will be negative responses affords managers the opportunity to address a stakeholder's negative influence in advance. By proactively addressing these negative influences, management can minimize their impact.

Stakeholder management requires a conscious effort on the part of an organization in order to be effective. Continual communication with the different stakeholders is necessary to understand their needs. Managers must actively negotiate with stakeholders on critical issues and often balance conflicting goals. For example, a shareholder's goal of increased profits may be offset by the Environmental Protection Agencies regulatory requirement for increased spending on hazardous waste management. By understanding stakeholder goals and anticipating their concerns, managers can more effectively define and achieve an organizational goals that balance stakeholder interests.

In summary, the stakeholder framework provides a descriptive, assessment, and analytical methodology for strategic management. It is particularly useful for strategic planning that must incorporate the interests of a number of distinct groups or individuals in order to achieve a common goal. Ultimately, the stakeholder approach builds bridges that foster better strategic management and allocates resources consistent with stakeholder concerns.

B. WEAKNESSES, OPPORTUNITIES, THREATS AND STRENGTHS MODEL

The Weaknesses, Opportunities, Threats, and Strength (WOTS-UP) Model is used to determine if an organization is prepared to deal with its environment. (Rowe,

1985) It is a strategic management technique that helps an organization determine its compatibilities with the environmental influences determined by stakeholder analysis. Using the WOTS-UP model strategic managers can recognize the weaknesses that may undermine an organization, the opportunities for the organization to excel, the threats to the organization's success, and the strengths upon which the organization can capitalize. With this knowledge, a manager can form a strategic plan that will minimize the weaknesses, seize opportunities, eliminate threats, and capitalize on strengths.

There are three basic steps to forming an effective strategic plan. First, managers must identify their core competencies. These competencies are the things the organization does well. Second, the organization must find a niche in their environment. A niche is a social or economic situation in the organization's environment that is well suited for them to exercise their core competencies. If the niche is effective, the organization can take advantage of opportunities and avoid threats. The last step is for the organization to find the best matches between its competencies and the available opportunities.

The WOTS-UP model provides a framework for the manager to identify their core competencies and the potential opportunities in their environment. Recognizing their weaknesses and avoiding threats to the organization will further assist managers in formulating a strategy for success. Before the model can be applied to a specific organization, the WOTS-UP terms must be clearly defined. The prescribed definitions (Rowe, p. 62) are as follows:

1. Weakness: A weakness is a limitation, fault, or defect of the organization that may keep it from achieving its objectives.

2. Opportunity: An opportunity is any favorable situation in the organization's environment that permits the organization to enhance its strategic position.

3. Threat: A threat is an unfavorable situation in the organization's environment that is potentially damaging to the organization and its strategy.

4. Strength: A strength is a resource or capacity that an organization can use effectively to achieve its objective.

The WOTS-UP categories come from both internal capabilities and environmental trends. Both strengths and weaknesses are attributable to the organization itself. These are internal capabilities that the organization can control to a certain extent. Opportunities and threats are external factors which the organization can not easily control. Ideally, managers exercise control by capitalizing on the strengths and correcting or compensating for their weaknesses. Although they may not be able to control the external factors, they can take measures to avoid threats and pursue opportunities.

The primary objective of the WOTS-UP paradigm is to find the best match between the internal competencies and the environmental trends. In order to conduct a WOTS-UP analysis there are two significant steps. First the manager must be compile key facts about their organization and its environment. From an internal corporate perspective, the manager should review factors such as the financial resources, facilities, employees, and management hierarchy. From an external corporate perspective, the

manager should look at the competition, market history, and trends in the economy, politics, and society. After these facts are listed, they should be categorized as a weakness, opportunity, threat or strength.

Once these facts are categorized, the manager should take a critical look at the number and significance of the facts in each category. Does the organization have a number of weaknesses? Are there many threats to the organizational objectives? What opportunities exist for the organization to achieve its objectives? These are all questions a manager with a comprehensive WOTS-UP analysis can answer.

A strategic manager can not fix a problem or take advantage of an opportunity unless he or she knows that it exists. Often, managers are so busy managing the daily operations and short term tasks, they fail to take inventory of the facts addressed by the WOTS-UP analysis. Although the paradigm may seem simplistic, it forces the strategic manager to take notice of the internal and external influences on the organization. Most managers are aware of the strengths and opportunities, but fail because they did not realistically assess the weaknesses or anticipate the threats.

With the WOTS-UP information, the manager can determine a strategy that addresses the positive and negative aspects of the organization. It is also possible that a factor could potentially be both. For example, affirmative action laws may be perceived as a threat and/or an opportunity for management. An effective strategic management plan would address both by ensuring the threat becomes an opportunity.

C. DIFFUSION OF INNOVATION

Technological innovation may have obvious advantages over current systems, but these innovations may not be easily adopted. Often there is a lengthy period between when an innovation becomes available and when it is widely adopted. Although people may know about the innovation, it doesn't spread as quickly as the initiator expects. During the period between knowledge of the innovation and its adoption, the idea may fail altogether. Consequently, a common problem for inventors is how to increase the speed that their invention spreads.

The speed that an invention or idea spreads is known as the diffusion rate. Diffusion is defined by Everret Rogers, author of *The Diffusion of Innovation* (1983), as the process by which an innovation is communicated through certain channels over time and among the members of a social system. When use of the invention begins to spread across the population, then it becomes an innovation.

By studying the diffusion of many innovations, Rogers devised a paradigm that explains and predicts the diffusion rate of innovations. Rogers explains that diffusion of innovation is "a special form of communication, in which the messages are concerned with a new idea." A significant characteristic of this form of communication is the "newness of the idea." Because of the newness of the idea, it possesses a certain amount of uncertainty. Therefore, Rogers attributes the inability of an idea to disseminate to an unacceptable level of uncertainty.

Many people believe that if an idea is good or an invention proves beneficial, it will spread quickly. However, Rogers demonstrates how surprisingly slowly diffusion occurs even when it is proven beneficial. Although this slow rate is not anticipated by inventors, it can be predicted using Roger's paradigm.

According to Rogers, the innovation can be any "idea, practice, or object that is perceived as new by an individual or other unit of adoption." Once the innovation has been developed, there is an innovation decision process where the individual passes from their first knowledge of the innovation to employment of it. This process includes five phases. The initial one is knowledge of the invention which is followed by persuasion of the individual to form a favorable or unfavorable opinion about it. The third phase is the decision to accept or reject the invention. In the fourth phase, the individual uses the invention and it becomes an innovation. By the final phase, the individual is or is not a confirmed adopter of the innovation.

The speed at which the innovation will diffuse is then determined by several attributes. These attributes can be measured and used to predict the rate of diffusion. The five attributes are relative advantage, compatibility, complexity, trialability, and observability. The definition of these attributes according to Rogers (1983, p. 15) follows:

1. *Relative advantage* is the degree to which an innovation is perceived as better than the idea it supersedes.

2. *Compatibility* is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of the potential adopters.

3. *Complexity* is the degree to which an innovation is perceived as difficult to understand and use.

4. *Trialability* is the degree to which an innovation may be experimented with on a limited basis.

5. *Observability* is the degree to which the results of an innovation are visible to others.

These characteristics of innovations can be evaluated and used to explain the different rates of adoptions. How the innovation is evaluated on each of these characteristics will vary with the view point of different potential adopters. One person may perceive a high degree of a characteristic such as complexity, while another person may perceive a low degree. Also, each of the innovation characteristics may have varying salience to different potential adopters. Positive characteristics may overcome negative characteristics. A high degree of perceived relative advantage, compatibility, trialability, and observability with a low degree of complexity will combine to increase the speed of diffusion.

While the characteristics described above are certainly not the only characteristics of an innovation, past research indicates that they are the most important factors in determing the speed of adoption (Rogers, 1983). By assessing these characteristics in advance, inventors can anticipate the response of potential adopters to their invention.

Additionally, they can use these characteristics to modify their inventions to accelerate the diffusion rate.

D. SYSTEMS DEVELOPMENT LIFE CYCLE

One of the principle systems development processes recommended at the Naval Postgraduate School for is the Systems Development Life Cycle (SDLC) process. It is defined as "a process by which systems analysts, software engineers, programmers, and end-users build information systems and computer applications." (Whitten, 1994) Throughout the computer industry, it is a methodology used for project development and management.

There are several phases to the SDLC process. These phases include systems planning, analysis, design, implementation, and support. Within each phase, there are several measures which are taken toward development, implementation and maintenance of the systems. Often, the process may not progress directly from one phase to the next because some measures in a previous phase may need to be repeated. Yet each phase builds upon the previous ones to ensure effective systems development.

Above and beyond the SDLC process, there are several other key principles to follow in systems design. First, it is important to get the user involved in the process in order to deliver a product that meets the users requirements. Because of these changing requirements and the expense of maintenance, it is also helpful to design a system that accommodates growth and change. This can be accomplished through modular code and dividing the system into separate subsystems. It is also helpful to establish consistent

standards for development and documentation of the systems. System developments that are not managed carefully may need to be canceled or may require modifications in scope. Last, any system must be soundly justified by examining the costs versus the benefits. By following these key principles in addition to the SDLC, system developers can increase the likelihood of a successful endeavor.

E. CHANGE MANAGEMENT

Introduction of wide area network communications throughout an organization is a significant change in information processing. In order to ensure success of the system, this change process must be carefully managed. However choosing a management strategy to implement change can be very difficult because of people's resistance to change. Consequently it is important for change agents to understand the causes of this resistance to change and the measures that can be employed to overcome it. By identifying and addressing these barriers to change, change agents can design an implementation strategy that effectively manages change.

Anticipating resistance to change sets the stage for change management. Prior to the implementation of the change, it is important to diagnose potential sources of resistance. Some of these include a low tolerance for change, threats to a self interest, misunderstanding of the implications of change, mistrust of change agents, and different assessments of the affects of the change. (Gabbaro, 1992) People may have a low tolerance for change because they fear they will lose their job competencies. The change may require them to learn new skills or change their behavior. During the period when

these new skills are developed, the people subjected to the change may feel uncertain and insecure in their abilities.

Change may also threaten some parochial self-interest. This self-interest may be tangible such as a financial gain or intangible such as power. By focusing on their on self-interest, they do not appreciate the benefits of the change to the organization. Protection of self interests can result in real or perceived political struggles between those who feel they have something to lose from the change and those who believe they will gain from it.

Resistance to change can also be the result of misunderstanding or fear of the unknown. The person may not clearly understand the ramifications of the change. If the change is technical, like the introduction of a new computer system, an employee may resist it because they don't understand it and are concerned about having the skills necessary to be successful. Resistance derived from the fear of uncertainty is heightened in an environment of mistrust. Change agents can be mistrusted if they are perceived to represent the interests of the organization and not the individual. If the individual is a union employee and the change agents are managers, the person may assume that the change is not in their best interest because they mistrust management.

All of these factors, including self-interest, low tolerance, mistrust, and differing perspectives, can precipitate resistance to change. The strength of these factors is proportional to the amount of resistance. Consequently, it is beneficial to the change process to anticipate the response of the people affected by the change and address any factors that cause resistance.

There are several ways to overcome the anticipated resistance to an organizational change. One of the most successful techniques is to educate people about the change prior to its occurrence. Through this education the change process and implications should be clearly communicated. Another effective measure is to allow the people affected by the change to participate in the design and implementation of the proposed change. By taking ownership of the idea, they are more likely to support it. If participation is not an option, it is important for the change agents to provide management support to the recipients of the change. (Gabarro, 1992) Management should recognize the impact of the change on the organization and help people to understand and accept it.

If the amount of resistance is significant, it may be necessary to employ more aggressive measures. Negotiating agreements with resistors to adopt the change in exchange for some type of incentive may be helpful. By giving a resistor a significant role in the design or implementation of the change, the change agents can co-opt the person into accepting the change because they feel somewhat responsible for it. As a last resort, change agents may also employ implicit or explicit coercion by hinting or threatening to fire someone if they do not accept the change.

The best way to overcome resistance depends on the situation. Each approach is appropriate for a different situation and each has advantages and disadvantages. It is also possible to combine the approaches. Additionally, the approach chosen depends on the cause of the resistance. For example, education is an effective approach when there is mistrust or inaccurate information about the change. Participation in the design and

implementation may be a good approach to overcome a self-interest. If no other measures will work, coercion may be the only option.

By identifying the causes of resistance, a change agent can determine the most appropriate way of overcoming this barrier to change. Anticipating the response of the organization to change will help to determine the most effective change strategy. Another significant factor is time. A strategy that must be implemented quickly must be clearly defined, include minimal involvement of others, and overcome any resistance through aggressive measures. A slower change process can have a more flexible plan, involve wider participation in the change process, and minimize the amount of resistance through less aggressive resistance management approaches.

There are also situational factors which affect the change process. First, the amount and type of resistance anticipated will change with each new situation because the environment and participants will change. The change strategy will also depend on the position of the initiator relevant to the resistors and how much power each possesses. It is also important to consider who has the data and energy to implement the change. Is it going to be entirely accomplished by the change agents or will it require the support of the other members of the organization? Last, the strategy will depend on the stakes involved. If the risk to the organization from the change is high, the implementation strategy will be slower.

Management can improve the success of their organizational change efforts by selecting a change strategy that effectively addresses the resistance to change. In order to

address this resistance, they must anticipate it and identify its causes. Once these causes are known, the aforementioned techniques can be employed to overcome the resistance. Without the resistance, the change can be implemented more easily. In order to ensure the resistance to change is under control, the change strategy must include a process to continually re-examine the amount and any additional causes of resistance. Ultimately, the strategy should identify the most appropriate measures to eliminate resistance as it occurs throughout the entire implementation process.

F. SUMMARY

There are several systems design methodologies commonly practiced by organizations who desire to implement information systems. Although the Systems Development Life Cycle (SDLC) management paradigm is strongly advocated at the Naval Postgraduate School, it is not necessarily the methodology of choice by system designers. It is often not chosen because SDLC is a too disciplined approach that can extend the development schedule and increase the cost of the system. Furthermore, SDLC requires a significant amount of input from the users in order to define the system, perform the requirements analysis, and design a system that meets the user's needs.

Often, an organization implementing a new information technology design assumes the users may not be able to identify their information system requirements due to low technological sophistication. Consequently, many systems are designed without the input

of the users. The philosophy of this type of developer is, "If We Build It, They Will Come." Because the developers believe they understand the users' requirements and the technology better than the users, they do not need the user input. (Markus, 1994)

Time and financial constraints can also mandate the "Build It And They Will Come" philosophy. If the developers are under pressure, they may skip several steps of the SDLC. Unfortunately, this may result in a system that the people do not want to use. This is the greatest risk of practicing a systems design paradigm that does not include the input of the users. Therefore it is imperative that system designers employ some techniques to assess the users' response. In this instance a stakeholder audit, diffusion of innovation survey, WOTS-UP analysis and change management theories will be used to predict the users response to NAVWAN.

Because the NAVWAN development team had limited time and money to develop the system, they practiced the "Build It And They Will Come" philosophy. However, they will evaluate the feasibility of the design by implementing the NAVWAN at several prototype sites before it is implemented throughout naval aviation commands. These prototype sites include NAS Lemore, NAS North Island, and NAS Miramar. To determine if the prototype meets user requirements, the user responses to the system must be assessed. From this assessment, the prototype can be continually modified until it meets the users' needs.

Effective prototyping requires iterative evaluations of the users' responses to the prototype. These evaluations provide the information necessary to create a prototype

model that will best meet the users' requirements. To assist NAVAIR in the development of their prototype of the NAVWAN implementation, I assessed the initial response of users at NAS Miramar. The purpose of this study is to demonstrate how a stakeholder analysis, WOTS-UP assessment, and diffusion of innovation survey can be used to recognize the factors that will influence the success of the NAVWAN implementation.

III. RESEARCH METHODOLOGY

A. INTRODUCTION

The intent of this thesis is to apply the theories outlined in the previous chapter to the prototype implementation of the NAVWAN at NAS Miramar. This opportunity was extended by the NAVWAN Program Manager at the Naval Air Systems Command. As the Program Manager, he is responsible for all the systems management teams who work on the design and development of the NAVWAN. Each team has a specific responsibility including wide area connectivity, system security, network operating systems, configuration management, tools and applications, and demonstration/validation.

B. ACTION RESEARCH

Action research is performed through participation by the researcher in the arena that is being studied. It is a research method that is achieved by combining theory and practice. The primary reference used for action research is a book titled *Research Methods And The New Media* by Frederick Williams, Ronald Rice, and Everett Rogers.

The role of the action researcher is to question the status quo. Because the action researcher is not subjected to any forms of organizational control, such as a supervisor, they have more freedom to question choices and decisions. They are not subjected to the same constraints and can give a more objective evaluation than the project manager. While performing action research, the researcher provides feedback to all relevant participants in the system of study. This feedback is derived from applying theory to

interpret events or data from the research site. Therefore, the action researcher participates actively in the process of change.

Measures taken by an action researcher can also facilitate change. Asking about alternative steps or providing alternative solutions to problems posed to the group can provide a different perspective. Once voiced, this perspective may be a catalyst for other participants to contribute to the change process. Further, a researcher attempts to balance the needs of multiple participants by ensuring their perspectives are considered. When discussions occur and decisions are made, the action researcher acts as a representative of different interests and challenges the status quo.

The ultimate goal of the action researcher is to enable participants of the system under study to gain value from the research process. This gain may be through the direct input of the researcher or through the response of the members of the group to the researcher's participation in the study. The collaborative nature of action research provides mutual benefits to both organizational participants and researcher.

Action research can be used in the design of a large system with multiple stakeholders. It provides the opportunity for the researcher to access, analyze, and provide feedback to individual stakeholders. The researcher can also be a catalyst toward forging together different stakeholder perspectives through the data gathering process. This provides an opportunity to unify the stakeholders to achieve a goal.

By participating as a NAVWAN Demonstration/Validation Team member, I had an opportunity to practice action research techniques. Based on my observations, I asked

questions and provided feedback to team members. As a member of the Demonstration/Validation Team, I participated in several respects. First, I attended several meetings where the members of the team briefed future users of the NAVWAN on its capabilities. These meetings were excellent opportunities to practice the action research techniques because I actively participated in the discussions. Second, I reviewed video teleconferencing sessions which the program manager held with the members of the different teams. Third, I regularly received and reviewed all the electronic mail correspondence between all the NAVWAN design and development teams and the program manager. All of these methods contributed to my understanding of the NAVWAN development and implementation process.

Data derived from my participation in the above activities formed the first phase of the research design. First, I determined that there were multiple stakeholders at the prototype site. By identifying these stakeholders, I could map them and determine their relationships to one another. The next phase of the research design involved interviews with the different stakeholders, to gather data relevant to systems design, innovation characteristics, and resistance to change. Through analysis of the interviews, I could more fully understand their stakes in the implementation of the NAVWAN.

C. SITE CHARACTERISTICS

The Miramar Naval Air Station (NAS) is located in Southern California just north of the city of San Diego. The Naval Air Station chain of command is similar to other air stations and includes the Commanding Officer, Executive Officer, Supply Officer,

Aviation Intermediate Maintenance Officer, Administrative Officer, Security Officer, Comptroller, Family Service Center Director, and the Staff Civil Engineer. All of these offices are currently connected on an Ethernet local area network (LAN).

Aboard the NAS, there are also several tenant activities. These activities have their own chain of command, but they rely on the NAS to support them in several respects. The NAS is responsible for all the facilities, supply, maintenance, and support services located on base for use by the members of the tenant activities. Some of the largest and most significant tenant activities include the Fighter and Airborne Early Warning Wings, the Personnel Support Activity Detachment, and the Naval Aviation Engineering Support Detachment.

Both NAS Miramar and these tenant activities report through Commander, Naval Aviation, U. S. Pacific Fleet eventually to Commander, Naval Air Systems Command. Because They are all subordinate activities of the Commander, Naval Air Systems Command, they are all potential users of the NAVWAN and were considered significant stakeholders in the demonstration/validation model.

Interviewing all the potential stakeholders in the NAVWAN implementation was beyond the scope of my thesis. Consequently, I selected the stakeholders with the most significant interests in the implementation of the NAVWAN at NAS Miramar. I also asked the Demonstration/Validation team members who they felt were the most significant

stakeholders. Based on their recommendations and my assessment, I selected twelve significant stakeholders.

The external stakeholders are the NAVWAN Demonstration/Validation Team members. This includes the NAVWAN Program Manager, the Naval Aviation Maintenance Office Representative, The Commander, Naval Aviation U. S. Pacific Fleet Representative, and the NAS North Island Naval Aviation Depot Representative. Ultimately, these internal stakeholders represent the vertical levels in the chain of command above the prototype site.

The internal stakeholders are the NAS Department Heads and the representatives from the significant tenant activities. The NAS Department Heads with a significant stake in the NAVWAN implementation include the Supply Officer, Aviation Intermediate Maintenance Officer, Administrative Officer, and the Staff Civil Engineer. The stakeholders included from the tenant activities include the Fighter and Airborne Early Warning Wings, the Personnel Support Activity Detachment, and the Naval Aviation Engineering Support Detachment.

In sum, there were twelve data sources. These sources include four from each category of the stakeholders including the internal NAVWAN Demonstration/Validation Team members, external NAS Department Heads, and external tenant activities. With several inputs in each category, the data should be less biased and address multiple perspectives.

D. DATA COLLECTION PROCEDURES

The interview technique was the primary data collection procedure. Each of the twelve sources of information were interviewed to obtain qualitative data regarding the NAVWAN implementation at the prototype site. To ensure the stakeholder representatives felt comfortable, they were interviewed in their work environment and at a time of their convenience. They were all asked the same 15 questions and completed a five question survey. Their responses were recorded on tape and supplemental notes were also taken. Most of the interviews lasted between an hour or two and they were conducted on a one on one basis. The AIMD and Supply Department Heads were limited to a half an hour due to schedule constraints. Although the stakeholders did not mention any concerns about anonimity, they were assured anonimity. Consequently, their names are not used and the data is often presented in an aggregate fashion.

The questions asked of each stakeholder representative are provided in Appendix A. Initially, the identification of each representative and the mission of their organization were determined. They were then asked general questions in the following four areas:

- What are information technology requirements of the command and how well the NAVWAN will support these requirements?
- How will use of the NAVWAN improve mission accomplishment?
- What is the anticipated response of the stakeholder users to the NAVWAN?

- What are the barriers to the implementation of the NAVWAN and how can they be overcome?
- What are the implications of technological change and what measures can be taken to manage technological change?
- What recommendations can be made to ensure continued NAVWAN evolution?

Following the interviews, stakeholder representatives were also surveyed about the diffusion of innovation characteristics of the NAVWAN. Each person was first given the aforementioned definitions of innovation characteristics including complexity, compatibility, observability, trialability, and relative advantage. On a scale from one to five, they were asked to rate the level of each characteristic of the NAVWAN relative to their average user. Although the sampling is too small to allow test of statistical significance, it does provide an indication of the stakeholders perspective of the diffusion characteristics of the NAVWAN.

Qualitative and quantitative data gathering techniques were used to collect data. Interviews were the primary qualitative source and the diffusion survey was the quanitative source. Other qualitative sources include the video observations, participation in meetings, and review of the E-mail. Each technique has advantages and disadvantages that must be considered prior to analysis of the data.

Interviews capture the exact words of the respondent and permit enough flexibility to explore issues and clarify comments (Huse and Cummings, 1985). These comments can increase the researcher's understanding of the respondent's perspective and provides

elaborative deteail appropriate for this type of exploratory research. However, the interpretation of qualitative data from interviews can also be subject to interview bias. Steps are taken, as addressed below, to minimize this threat to reliability.

E. ANALYSIS TECHNIQUES

Both qualitative and quantitative data gathering techniques were used to collect data. Interviews and observations were the primary qualitative sources, while the diffusion survey was a quanitative source. All three techniques have advantages and disadvantages that must be considered in the analysis of the data.

The data gathered in the interviews was analyzed using the stakeholder, WOTS-UP, and diffusion of innovation paradigms. Before the data could be analyzed, it was organized and reviewed to determine the major issues. The significant stakeholders, their missions, functional requirements, and relationships were identified. With a clear understanding of the stakeholders, their unique issues and commonalities surfaced. These factors provided the data for performing the WOTS-UP analysis and determining the fit between the NAVWAN and its prospective environment.

The analysis of the data was performed in several steps using different paradigms. The first step was to map the stakeholders, their relationships, and their stakes in the NAVWAN implementation. Based on these descriptive maps, the stakeholder analysis was performed to note the implications of the NAVWAN implementation. The WOTS-UP analysis was then used to identify the weaknesses, opportunities, threats and strengths of the NAVWAN from the stakeholders' perspectives. From the WOTS-UP information,

recommendations for the NAVWAN implementation strategy at other activities were derived.

Although the results of the survey are not tested for statistical significance, they do give some indication of the NAVWAN diffusion potential. The characteristics also demonstrate potential strengths and weaknesses of the NAVWAN's current capabilities. This diffusion feedback clearly indicates some of the factors which may prohibit or facilitate implementation.

IV. RESULTS

A. INTRODUCTION

Identifying the significant stakeholders, command missions, and information technology requirements of the stakeholders are the initial steps in reporting the results. As previously stated, the significant stakeholders of the NAVWAN implementation at the prototype site are the NAVWAN Demonstration/Validation Team, NAS Miramar Department Heads, and significant tenant activities. These stakeholders represent all levels in the naval aviation chain of command including headquarters, depot, type commander, air wing, and organizational activities.

Although their missions differ, many of the stakeholders have similar information technology requirements. Data gathering interviews helped to familiarize stakeholders with the NAVWAN capabilities and fuel their interest in its implementation. Because of the NAVWAN open systems architecture, stakeholders do not expect it to significantly constrain their mission accomplishment. In fact, all of the stakeholders anticipated significant benefits from interconnectivity with an array of Department of Defense, federal, academic, and civilian organizations.

Because of these benefits, the stakeholders believe there is great motivation for their users to employ the NAVWAN and that it will increase user productivity over the long run. Increased productivity is believed to directly support mission accomplishment.

Consequently, the NAVWAN implementation is generally supported by each stakeholder chain of command.

However, there are barriers to the implementation of the NAVWAN at the prototype site. Some of the stakeholders offered solutions to overcome these barriers. However, these solutions were not universal among the stakeholders and the solutions offered did not address all of the barriers. Knowledge of the barriers and recommendations identified by this thesis will assist the NAVWAN Demonstration/Validation Team in prescribing effective approaches to future NAVWAN implementation at other locations.

B. INTERVIEWS

A complete list of the stakeholder interview questions is provided in Appendix A. To facilitate the reader's understanding of the data presented below, the topic or question is provided at the beginning of the subsection and a synopsis of the stakeholder responses follows. Responses that were common to all or several of the stakeholders are provided first. Specific stakeholder perspectives and quotations follow these generalities.

1. Identification of The Stakeholders

All of the stakeholder missions support naval aviation chain of command. In this thesis, the external stakeholders are members of the Demonstration/Validation Team. Internal stakeholders include the NAS Miramar Department Heads and significant tenant activity representatives. These stakeholders and the general mission of their organization follow:

(a) **NAVWAN Program Manager, Headquarters, Naval Air Systems Command (NAVAIRSYSCOM)**. This command directs all naval aviation systems design, development, procurement, and management policy.

(b) **NAVWAN Demonstration/Validation Team Member, Naval Aviation Maintenance Office (NAMO)**. This command is responsible for all aspects of naval aviation maintenance and administration programs.

(c) **NAVWAN Demonstration/Validation Team Member, Naval Aviation Depot, NAS North Island (NADEP).** This command provides intermediate level aviation maintenance support for Pacific Fleet aviation activities.

(d) **NAVWAN Demonstration/Validation Team Member, Commander, Naval Aviation, Pacific (CNAP).** This command promulgates policy and asset management direction to all Pacific Fleet aviation activities.

(e) **Supply Department, NAS Miramar.** This department is responsible for all logistic and supply support required by the squadrons and tenant activities of NAS Miramar.

(f) **Aviation Intermediate Maintenance Department, NAS Miramar (AIMD)**. This department is responsible for all intermediate maintenance services required by the organizational squadrons at NAS Miramar.

(g) **Administration Department, NAS Miramar (ADMIN)**. This department is responsible for all postal and administrative services required by NAS Miramar personnel and its tenant activities.

(h) **Staff Civil Engineering Department, NAS Miramar**. This department is responsible for all facilities maintenance, construction, hazardous waste management, and environmental conservation required by NAS Miramar and its tenant activities.

(i) **Personnel Support Activity Detachment, NAS Miramar (PSD)**. This activity is responsible for all personnel and disbursing administration for NAS Miramar and tenant activity personnel.

(j) **Commander Fighter and Airborne Early Warning Wings Pacific (COMFITWING/COMAEWWING).** These aviation type wings are responsible for administration of all operational, maintenance, and administrative support for the squadrons located at NAS Miramar. There is one stakeholder representative for both commands.

(k) **Naval Aviation Engineering Support Unit (NAESU).** This activity is responsible for providing technical support and maintenance training to organizational activities throughout the Pacific Fleet.

(l) **Information Systems Support Office, NAS Miramar (ISSO).** This division is responsible for providing information technology support to NAS Miramar and tenant activities.

Each stakeholder provided a designated representative to answer the questions on behalf of the organization. Therefore, the responses are only attributable to the representative and may not reflect the opinions of the chain of command. Any mention of the stakeholder command should be attributed only to the stakeholder representative and not the organization itself.

These stakeholders have diverse missions and responsibilities. The NAVWAN will be a conduit for them to communicate at the local, metropolitan, and global levels. Through improved communication, these activities will also be prepared to provide information and support throughout the Navy.

2. Knowledge of Current Capabilities of NAVWAN

At the time the interviews were conducted, nine of the twelve stakeholders had a clear understanding of the initial capabilities of the NAVWAN. The Supply, ADMIN, AIMD, ISSO, and COMFITWING/COMAEWWING representatives attended an

orientation brief presented by the NAVWAN Demonstration/Validation Team. During the brief, the NAVWAN Team provided extensive information about the capabilities of the NAVWAN and the impending implementation at NAS Miramar.

Other stakeholders were aware of the NAVWAN implementation plan, but were not familiar with its specific capabilities. As information technology managers, these stakeholders have a clear understanding of wide-area connectivity, but they were not certain of the exact functionality the NAVWAN will provide.

During the interviews, initial capabilities were explained or reviewed with the stakeholders. These capabilities include global electronic mail, a comprehensive electronic mail directory, and file transfer across multiple platforms throughout NAVAIRSYSCOM and its subordinate activities. Planned future capabilities include shared databases, global applications, and Internet access.

The response to the NAVWAN initial capabilities was generally positive but somewhat skeptical. Some of the stakeholders believe it would be technically infeasible to provide wide-area connectivity across several platforms and multiple interfaces because of the reduced speed and performance. Standardization of interfaces and platforms was repeatedly advocated to facilitate the implementation process.

NAS Miramar Department Heads and ISSO were concerned about the LAN interface with the WAN because the LAN is limited in its capabilities. Currently the LAN is run on coaxial cable and twisted pair copper wire. Therefore, the speed of the WAN transmissions cannot be maintained on the base. "If the performance of the WAN is

limited by the LAN, people will not be that impressed, because it is definitely not high speed" according to the ISSO representative. The AIMD is also dissatisfied with the current LAN E-mail system and felt the NAVWAN would be used more if the current E-mail system was changed.

NADEP, AIMD and Supply were the most enthusiastic about E-mail throughout NAVAIR because they rely heavily on information and support from other NAVAIR activities to perform their jobs. E-mail communication and online database access will make their jobs much easier to perform by eliminating other less efficient modes of communication and reducing the delay time for aviation maintenance and supply management information.

CNAP is most interested in running Naval Air Logistics Command Management Information System (NALCOMIS) on the NAVWAN to the squadrons. NAVAIR, NAMO, and COMFITWING/COMAEWWING also support this concept because "NALCOMIS is the only system most squadrons have at this time." By combining the NALCOMIS and NAVWAN initiative, CNAP states, "they can both take advantage of existing resources and couple their assets for combined benefits. Coordination of this effort would greatly reduce the duplication of effort that is currently occurring."

3. Stakeholder Functional Requirements

Many of the stakeholder information technology functional requirements are common to all the stakeholders. Office automation, including word processing and file transfer, are required by all stakeholders. Word processing is a requirement that is already

met, although many different applications and software versions make it difficult for documentation management throughout the chain of command and between activities. Communication tools, such as message traffic management, bulletin boards, database management, and electronic mail applications, are other common requirements for all stakeholders.

Several stakeholders, including the Supply Department, AIMD, PSD, and COMFITWING/COMAEWWING, require access to real time database management systems (DBMS) particular to their missions including aviation maintenace administration and logistics information. They would also like the DBMS to have a structured query language for personnel inquiries and updates of logistics and maintenance material control data. Decision support tools for spreadsheets and graphics presentations are also required by these stakeholders. The latter applications are primarily used to compile aviation maintenance and logistics data and demonstrate system performance.

Above and beyond these common requirements, there are a few specific information technology needs. NAESU and AIMD believe they would benefit from workstations that provide three-dimensional graphics and access to technical drawings. If the engineers and aviation maintenance technicians had access to these designs, they would not need to use technical publications which are often confusing and outdated.

NAESU also said they would benefit tremendously if the NAVWAN bandwidth was expanded to include teleconferencing capabilities. Because NAESU supports many remote locations including Hawaii, Guam, and Japan, teleconferencing with their remote

activities would permit technical video consultation. The NAESU technical representatives and engineers often attend professional conferences and symposiums that could be accessed via teleconference sessions instead. This capability is expected to greatly reduce travel costs and increase the productivity of scarce technical resources. Further, it would allow more of the technical representatives to participate.

4. Achievement of Functional Requirements

Eventually the NAVWAN may achieve all the information technology requirements of the stakeholders, but it does not meet their needs at this time. These functional requirements are currently met through the use of multiple systems including local area networks, electronic mail, postal service, fax, modem, phone, and voice mail. Although the naval message system is difficult to use, it continues to be one of the most popular methods of communication. Mainframe logistics systems, technical publications, and an array of software packages are also employed by the stakeholders.

NAESU is concerned that the NAVWAN will become one of many communication systems that must be periodically checked. Currently they must read the message traffic, check the fax machine, review electronic mail, answer the phone, reply to voice mail, and access bulletin boards. They are overwhelmed by the number of existing communication tools. Consequently, NAESU fears they will miss important messages because they are busy responding to another system. The frustration of having to log on and log off several systems was evident in the comments of the NAESU representative.

> The number of mailboxes with my name on it is ridiculous. I have to check them every day; sometimes several times a day. If they're going to bring the NAVWAN online, they need to eliminate some of these other systems and make everybody use it; instead of just adding another mailbox. Logging on and off all these systems . . . it's just too much.

The COMFITWING/COMAEWWING representative also hopes introduction of the NAVWAN will eliminate some of the current systems. In this command, not all the personal computers are connected to the local area network or have modem capability. "If a person wants to do word processing, they can use a Zenith 286 computer. If they want to send E-mail, they must find a computer on the local area network. If they want to access a bulletin board in another command, they need to find a computer with a modem." All three functional capabilities are available at the type wings, but they are not on the same computers. The LAN computers don't have modems and the Zentih 286 computers do not have network interface capability.

Using multiple platforms to perform functions that could be performed on one platform is inconvenient and inefficient. "Providing NAVWAN access to everyone will hopefully eliminate this inefficiency" sums up the COMFITWING/COMAEWWING response.

Acknowledging similar concerns to those stated above, NADEP's representative stated, "NAVWAN is a start, but it's not enough." He goes on to say that "compatibility between the sites continues to be a problem, because there are so many different stovepipe networks. We need to build on the NAVWAN functionality in order to provide full service including real-time database management and shared applications."

Supply's representative also said the NAVWAN won't meet all of their functional requirements because they use so many different systems. "If all of these systems could be consolidated into the NAVWAN, then we'd be in business, but I don't think its going to happen too quickly . . . too much rice bowling." He insists that "people simply aren't going to give up their existing systems." As expressed by NAESU, "unless all the NAVAIR systems are accessible via the NAVWAN, it becomes just one of many systems available." NAVAIR determined the initial functional requirements to be E-mail with an integrated user directory and simple file transfer and thus established the NAVWAN with those capabilities. They did not intend to meet all the user functional requirements at the outset. NAVWAN functionality is evolutionary. NAVAIR will continually evaluate the users functional requirements and add functionality in layers. "The next layer will use existing assets more and employ commercial off-the-shelf applications to minimize the development effort," says the NAVAIR representative. "We will continue to address emerging requirements and try to merge requirements into the NAVWAN that will address multiple protocols," was the NAVAIR assessment of the NAVWAN future capabilities.

5. NAVWAN Support of Mission Accomplishment

All the stakeholders stated that the NAVWAN would directly support mission accomplishment in some respect. ISSO and COMFITWING/COMAEWWING believe it will support mission accomplishment more as it grows and other systems are eliminated.

ISSO, PSD, NADEP, and ADMIN all want to use the NAVWAN to provide better support to their customers.

However, if their customers are not connected to the NAVWAN, it doesn't help them achieve their mission. In the words of the PSD stakeholder, "It will directly support mission accomplishment by improving the efficiency of the clerks and their ability to provide customer service. This affects every sailor in the Navy, because they all have personnel and pay records, but they are not all hooked up." The COMFITWING/COMAEWWING stakeholder adds, "Until the squadrons are hooked up, it is just a support device."

NAVAIR disagrees with this perspective and states, "Everybody will need to be connected to get their job done . . . it is no longer just nice to have." CNAP supports this stance with "the NAVWAN is essential to mission accomplishment, because everything will be done electronically in the future. Everybody will need a link."

ISSO and the Supply Department support NAVAIR and CNAP. ISSO says, "It is definitely supported by the chain of command and they are anxious to receive it." Supply agrees and states, "The chain of command definitely supports it, but they are not coming forward with the money because we just don't have the manpower or the money to support it right now."

6. NAVWAN Interconnectivity

All the stakeholders believe NAVWAN will improve their communication with other commands throughout the Navy including NAVAIR, BUPERS, NAVSUP,

CINCPACFLT, CNAP, NAMO, NALDA, ASO, and other Naval Air Stations. Not all the organizations are part of NAVAIR. Consequently many stakeholders suggested that the NAVWAN should be a Navy-wide initiative. "It will greatly expand what we can do and whom we can contact, because every command in the Navy would be a possibility" according to the COMFITWING/COMAEWWING representative.

"If the wide-area network connectivity was coordinated on a Navy-wide basis, the NAVWAN would definitely be more beneficial because then you wouldn't need to figure out who is on the network and who isn't" said the ADMIN stakeholder. "Why should I type something up twice, if I can send it once with a Navy message. If you could eliminate the hassles of the Navy message system and put everyone on the NAVWAN, then you would really be helping us out!"

According to the NAVAIR representative, communication throughout the Navy is not yet possible. The accessible organizations "will depend on who is on the NAVWAN and if their network protocol can be accommodated." Fortunately the comprehensive directory of all the users will assist people in determining who is available on the NAVWAN.

Many of the stakeholders strongly desired the NAVWAN to expand to incorporate the communications normally found in messages via Defense Message System (DMS). "The message system format and constraints just make it too hard . . . anything would be better than that" was the comment of the AIMD representative. The CNAP stakeholder representative agreed and added "I want to see everything funneled into NAVWAN and

we need to bring all types of connectivity initiatives together if we're going to achieve this."

Ultimately the NAVWAN Demonstration/Validation Team wants to provide access to anything with a MILNET address. This would permit communication throughout DOD, but the stakeholders question, "What about interagency exchanges of information?" The Staff Civil Engineer, NAESU and NADEP want to go beyond MILNET addresses to the commercial networks that would make numerous defense contractors and academia accessible.

NAVWAN communications are currently limited to NAVAIR and most MILNET addresses. Still, the possibility of the complete Internet access exists and the NAVWAN Demonstration/Validation Team members have considered this possibility. NADEP has pursued commercial Internet resources in the San Diego area and proposed two major gateways. These gateways would be in the China Lake and Patuxent River locations. At these locations, the gateways can be closely monitored by the NAVWAN system administration.

Although Internet access was not one of the initial functional requirements of the system, it quickly became an interest of all the stakeholders. During the presentations by the Demonstration/Validation Team, it was repeatedly requested. Although stakeholders are interested in wide-area connectivity between MILNET addresses, they were definitely more interested in Internet access.

Improved communication within the Navy and throughout DOD was welcomed, but the stakeholder often pointed out that it is achievable via other means including the Defence Message System. However, the possibility of Internet access was certainly greeted with enthusiasm. According to the AIMD representative, "The Internet will be the bait I use to get the users interested in the NAVWAN."

7. Benefits of NAVWAN Interconnectivity

NAVWAN stakeholder responses to this question were overwhelmingly positive and provided some unique perspectives on NAVWAN implementation. The COMFITWING/COMAEWWING representative summarized the most common responses; "Increased communication is the single most important thing to come out of the NAVWAN implementation, next would be potential cost cutting from the reduced phone use, and third is the potential Internet access."

ISSO believes "they will use it because it's faster than other methods of communication, time will no longer be a factor, and it increases productivity because you will have a quicker response time." He also believes that use of the NAVWAN will spread quickly because "users want to be a part of it, because they know other people have it and they want to be able to use it." People are already asking him for their address and "they're not even hooked up yet . . . There's a certain amount of status that comes from having that E-mail address to give out to people and they are embarrassed when they don't have one." The address is perceived as "the key to the whole world."

Because everyone in NAVAIR will eventually be on NAVWAN, NAESU felt that NAVWAN would "improve coordination with the headquarters and the customers at the squadron level." The total view of the NAESU organization and databases will provide real-time information and reduce errors. This should mean "less finger pointing and improved accountability of the information" throughout NAESU. For work requests, it will also "mean less delay in communication, quicker responses, and approvals of work."

NAESU also cites, "Access to technical data would be a great motivator for them to use it." He recommends that they use it to talk online to give or receive technical advice for the Integrated Logistics System Maintenance Training conferences. "They could also talk to people that they meet at the program management reviews and when conducting investigations." He suggests following up via teleconferencing sessions, because it would reduce travel costs and maximize the use of scarce technical resources.

NADEP's perspective was somewhat different from the other stakeholders. This response was given regarding the benefit of the NAVWAN to the Navy. "Hopefully the NAVWAN will right-size the systems support staffs by consolidating everyone. There's too much duplication of effort by all the AIS staffs. Here on North Island, we have the Defense Mega Center, Naval Computer and Telecommunication Center, CNAP AIS, NAS North Island AIS, and NADEP AIS." NADEP is also concerned about the configuration management between these commands. "Now everybody is using all different applications and all different versions. The NAVWAN may help to standardize things."

Additionally, the NADEP representative believes the Navy could benefit more from the NAVWAN on a Navy wide basis. "The Navy needs economies of scale in purchasing hardware and software that we can't achieve unless we consolidate." Lastly, the NADEP representative cited the benefit of improved integrity of the data in the databases for logistics and aviation maintenance purposes.

Faster communication, elimination of paperwork, and progress toward a paperless Navy were the benefits cited by the PSD stakeholder representatives. "We need to get rid of all the file cabinets." He also stated that the trade-off between the costs and the benefits of using the computers needs to be measured. "If the benefits outweigh the costs, we need to move in this direction and stop slowing the process down." Eventually, PSD wants all personnel records to be computerized and to electronically transfer records between commands.

PSD, ADMIN and CNAP believe people will be motivated to use the NAVWAN because it will help them get their jobs done more efficiently. From PSD's perspective, "The number one job of PSD is to provide customer support. With WAN capability they will be able to improve their customer service by responding more quickly and answering questions over E-mail instead of them coming in." CNAP added, "Communicating with all the wings at one time, vice sending individual correspondence or phoning them, will increase the speed and there will be more communication. I believe this will help to prevent problems that occur when people are not informed."

"Flexibility and responsiveness will be increased through the use of the NAVWAN," according to AIMD. "It will solve the message traffic problems and we can stop faxing people messages to make sure they got them, the present system is just too hard." AIMD also wants to "edit and endorse ADMIN stuff on the system." He believes "it can be an incredible information exchange, if we would just use it." ADMIN would also benefit if all correspondence was on the system, but the representative wasn't sure everybody would be willing to put their correspondence on the system.

Reduced phone delays were the greatest benefit to the Staff Civil Engineer. "It will save time, because you don't need to keep calling and waiting for response when the person may be on leave. You just send the message and they get it at their convenience and there are no problems with time zones either." They also felt it would be a big improvement over the current message system. "DMS is too slow and hard to use. It will be a big improvement over DMS." Unfortunately, the NAVWAN can not replace DMS because it is not a secure network. However, it is possible to use the NAVWAN to send and receive unclassified message traffic. Even so, the Staff Civil Engineer stated that the NAVWAN would be more beneficial than existing systems because "it provides for a better communication flow than the fax machine or mail system. Nothing could beat it if it works."

As a member of the Demonstration/Validation Team, NAVAIR had a different perspective on the benefits of the NAVWAN than the other stakeholders. The representative sited the benefits of "tangible cost reduction and reoccurring cost reduction

through circuit consolidation, reduced maintenance and support effort, and improved configuration management." He also stated that "buying more capacity at a better price through economies of scale" would also reduce the costs for all the NAVWAN users. Greater NAVWAN capacity ideally provides usage at an increased speed with improved reliability.

The NAVWAN Team intends to employ metrics that allow process control and performance measurements. These performance metrics will allow NAVWAN system managers to isolate problems and address them. NAVAIR appreciates the ease of use of the NAVWAN at a time when there is exponential growth of E-mail messaging. Furthermore, he expects the NAVWAN to have increased reliability over the existing stovepipe systems because of these performance measurements and controls.

NAMO is also a member of the NAVWAN Demonstration/Validation Team. He views "easy to access corporate data with reduced or eliminated duplication of data risk" as the most significant benefit. He believes the users will "appreciate Internet access most and the same or increased service at a reduced price." As part of the NAVWAN Team, his job is to convince potential users that these benefits will outweigh the costs.

8. Functional Requirements As Constraints to Implementation

None of the stakeholders believed the implementation of the NAVWAN would significantly constrain the accomplishment of their functional requirements. Although it has an open-system architecture, the NAVWAN cannot accommodate every protocol

currently in use throughout NAVAIR. However, it does accommodate the system protocols necessary for the stakeholders to employ it.

Many stakeholders stated that most of their functional requirements are already met by other systems. It was also suggested that the less efficient systems could be eliminated or used as backup systems for the NAVWAN. As a result of the existing systems, COMFITWING/COMAEWWING explained that "point to point communication will help a lot but you will have some duplication of effort until everyone is connected to the NAVWAN." Although some duplication of effort may be acceptable, it does reduce productivity. Still, ISSO, NADEP, NAMO, ADMIN, and Supply did not think that elimination of these other systems would occur too easily because the users are more familiar with the current system and believe they are sufficient.

ISSO, ADMIN, and COMFITWING/COMAEWWING were concerned that the potential for abuse and security risks would constrain the achievement of functional requirements by the NAVWAN. They pointed out that people could not use it for anything that is classified or of a sensitive nature. This would include a significant amount of message traffic. "People will still send messages [using DMS] for the important stuff, because that's the standard way of covering your six" according to COMFITWING/COMAEWWING. ADMIN agreed that "duplication of effort will occur initially because people wont' trust it. The need to protect sensitive information like investigations and HIV positive personnel management issues still exists."

With the duplication of effort there may be a decrease in productivity of the users. However, most stakeholder representatives stated NAVWAN use will increase productivity. They were more concerned about that abuse of the system will be a productivity drain. "The productivity of the users will definitely increase, if they are using it for work and not abusing it" is the primary concern of ISSO. "The temptation to surf all day on the Internet may be too great for some people." Consequently he advocates "restricted use and the development of policies to ensure people are using it for productive purposes." CNAP supports this position because "productivity will probably increase, but it could be reduced by people playing around. We need to figure out a way to control abuse although it is part of the learning curve."

NADEP explores the topic of abuse a bit further. "The NAVWAN is a convenient method and it helps people in their job performance, but there is the potential for abuse and personal pursuits which will reduce productivity. Yet there's a lot of integrity out there of both civilian and military personnel. They are trusted not to abuse it." He believes that people will not abuse the system for personal business. He thinks the greater threat is from outsiders. "We are evaluating firewalls and filters, not necessarily to keep people from going out, but to keep other people from coming in."

Another concern about abuse of the NAVWAN was voiced by ADMIN who cautioned that having everybody on the NAVWAN "will take away some people's power." She is concerned that people will use the NAVWAN to circumvent the chain of command. She feels that "there are power issues here, not just communication issues."

By implementing the NAVWAN, she feels "the chain of command loses some power over their subordinates." ADMIN adds to this political issue by stating "Power issues are going to be a big problem." She agrees with AIMD in her statement "they [senior officers in the chain of command] don't want you talking to anyone outside the chain of command."

AIMD recommends strict policy guidance and enforcement of the chain of command even when the NAVWAN is used. "People need to know their level of authority and have confidence in their subordinates to keep them informed because they might not see all the transactions or know everything when communication occurs over the E-mail." Trusting people to keep the chain of command is a significant issue for him at AIMD.

These political issues can lead to resistance to change which is also a significant constraint in the NAVWAN implementation. At COMFITWING/COMAEWWING the resistance to the LAN may transfer to the WAN. The type wing representative was greatly concerned about this constraint.

> People really resisted the network at the start because they are not computer literate and they didn't want to change . . . they felt it would make their job harder, but they get over it once they understand. For example, one secretary in a group typed up E-mail and sent it to another secretary so the whole group ran to the other office to see it and were really excited when it arrived. Many of the potential users still have computer phobia and feel the network is too hard, but then they realize that they have the power to reach out, touch a button, and go across the world.

Another constraint is inadequate technical resources. Currently, the NAESU LAN only has five terminals hooked up. The limited size and capacity of their LAN and

facilities are a big constraint according to their representative. Eventually, they would like to be able to communicate with all the regional offices and tech representatives when they are traveling. Poor communication with technical representatives, while they are traveling to different work sites, is the greatest constraint of their mission accomplishment. If the NAVWAN assists NASEU in overcoming this communication problem, it will improve their performance and achievement of their functional requirements.

From NADEP's perspective, the constraint of no access to the Internet is a big issue for the users. "This is a big requirement, which we want to provide, so we're looking for two large gateways for Internet access through a commercial source." NADEP felt the functional requirements of the NAVWAN for the users would not be satisfied until Internet access was provided. Although it is not an original functional requirement, it quickly became an issue with the potential users who consistently requested it during briefs and interviews.

NAMO expressed many concerns regarding constraints on the achievement of functioanal requirements from the development perspective. Because there are so many commands working together on this project, there are different tasks, schedules, and resource priorities. The NAVAIR Team concept does not always allow the Demonstration/Validation Team to have access to key people who have direct obligations to other people or to other projects.

> I have personally hooked up sites ahead of schedule because I needed them to be online and the infrastructure coordination problems could not be resolved. We had to do a lot of negotiating to get the support we need because the key people don't always work for us. I'm working hard to incorporate both NAVAIR and NAMO information technology goals.

NAVAIR agrees with the TEAM constraints discussed by NAMO. He also states that there are more technical constraints than they anticipated. "The users can't establish and operate their own [local area] network independent of the NAVWAN. These constraints are imposed with the interface standards." The NAVWAN currently accommodates four protocols, "because they can't afford to standardize 22 different sites." The NAVAIR stakeholder provides an analogy of the NAVWAN as a utility. "The NAVWAN must have the same voltage and provide reliable service, but everyone uses the same source and electronic standards to make their appliances run."

NAVAIR is also concerned about the political constraints against standardization. Although they have reduced the number of original E-mail systems, standardization has been difficult.

> Hopefully we will migrate to one standard because we now have 22 commands doing different things. Each program or project has their own network, each activity has a stovepipe, they are integrated vertically but not horizontally. Just because we have the infrastructure now, doesn't mean they will be horizontally integrated. The infrastructure is not sufficient to solve the interoperability problems.

Interoperability seems to be the greatest constraint to the NAVWAN implementation. The Demonstration/Validation Team has not been able to overcome these interoperability problems at all the sites. Because they want to take advantage of the existing architecture, they cannot standardize everything to one system. They continue to have problems migrating the existing systems at the 22 NAVAIR activities to the four protocols selected for NAVWAN implementation. "It is technically feasible, but there may be some performance issues that we'll need to measure and correct" is the summary of NAVAIR.

9. Barriers to NAVWAN Implementation

Nearly every stakeholder agreed that money is the single biggest barrier to the NAVWAN implementation. At the type wings "we just don't have the money we need to support the LAN, let alone the NAVWAN" was the initial reaction of their representative. Money also limits the technical capabilities of the type wings. "We still have a number of 286's and they can't use a fiber optic network interface card. We have fiber throughout the building, but we need fiber connectors and they're too expensive." The information technology budget at many command is very limited and they don't believe it will change in the near future.

Supply adds that "the BRAC has greatly limited funds because the ISIC (immediate superior in charge) has stopped the funding as of September 1997." He agrees with this move and does not intend to provide any additional funds to support the NAVWAN. He asks, "Why should they invest in something that we won't be able to use?

We simply don't have the money to do it." The biggest barrier for PSD is "definitely money for the hardware, software, and training . . . We currently have a $1.3 million unfunded request into CINCPACFLT that doesn't include the NAVWAN."

NAVAIR disagrees that the greatest barrier is money. He says "it is not so much money itself, but the ability to direct the money; especially where personnel are concerned." From his perspective as the program manger, the development effort is heavily loaded on the civil service personnel. He gets frustrated because "we can't hire and fire people as we would like and we don't have the right mix of people. Eighty percent of the IT people are not involved and the twenty percent who are, don't have the time to dedicate to it."

Time and manpower are commonly mentioned barriers to the NAVWAN implementation. In the ISSO office, there are only four people and they are always putting out fires in other places. "We simply don't have the time or people to conduct the necessary training and perform the network administration, maintenance, and support." NADEP agrees that there are also limited technical personnel and sufficient manpower resources dedicated to the NAVWAN project.

CNAP adds that because there are so few people, "the barrier to implementation becomes the schedule and workload priorities of the implementation team." In her words "there are conflicting priorities for the people working on it and they have difficulty knowing where the resources are going to go." She also believes that the BRAC initiative

"effectively shuts down what I would do at NAS Miramar. The Marines would benefit but they don't belong to me so why should I put my money there."

One of the most significant barriers then becomes politics. NADEP points out, "The rice bowls are difficult to overcome. People don't want to admit it, but they want to preserve their islands of communication." He believes people want to "put their own bridges into the NAVWAN, but they want to perpetuate isolated applications." The AIMD stakeholder also mentioned "rice bowls" and he adds, "Going through the chain of command slows down the process, people in your chain of command don't want you to talk directly to people who aren't directly in your chain of command."

NAVAIR also warns, "E-mail is a democratizing agent in the organization" that may affect the chain of command. If an airman wants to send the commanding officer E-mail, he can do so without asking his supervisor or division officer. Lastly, NAVAIR is concerned that "business is depersonalized by not requiring face to face contact intra command . . . people just send E-mail."

Although NAVWAN E-mail communications may be easier than other forms of communication, she believes the old correspondence methods "will die slow deaths" because of these political issues. Regarding the commanding officers (CO) and executive officers (XO), she states, "They want a hard copy piece of paper and signature so they can hold you accountable and save themselves if something goes wrong." Furthermore, she doesn't believe the NAVWAN communications will be used for any significant communications because "the CO and XO will want to see it and touch it or edit it before

you send anything." She feels this barrier "slows down the process and defeats the purpose."

From the ADMIN perspective, "Politics will definitely be a big barrier." She believes this will perpetuate until senior officers are more computer literate. "The people in power were not raised with computers and they don't like it when their children are smarter than they are." She points out that "the people who understand this system are the junior people and the senior people won't trust them with it because there are some issues that must be protected."

NAMO believes the politics will eventually be overcome by the functionality of the system. He admits that "the standard resistance to change will occur, so it takes awhile for them to learn that it's easier for them to use the NAVWAN." In time, he believes this resistance will be overcome. "Once they realize how easy it is to use the NAVWAN, you won't have any problems," said NAMO.

The COMFITWING/COMAEWWING representative believes "computer phobia" will be a significant barrier to implementation. He states that "computer phobia is out of control." In this stakeholder's opinion, "Everybody is freaking out about hackers." As a result, he believes "It is important to practice computer security measures, use access matrices, have two system administrators, close holes, and perform virus checks to and from the servers at all times."

The resistance of people to using computers was also mentioned by NAESU, NADEP, and NAVAIR. If people are not comfortable using the computer, they will not

use the NAVWAN. Alternatively, they will continue to use the tools they are familiar with as long as these tools are available.

Several stakeholders, including COMAEWWING/COMAEWWING, NAESU, PSD, AIMD, and the Staff Civil Engineer, recommended mandated use of the NAVWAN. AIMD voiced this concern best in his question; "Are people going to be more responsive to the NAVWAN than other forms of communication or is it just something else to work with?" If people have a choice of communication products, the NAVWAN may not be utilized to the extent of justifying its cost.

On the other hand, NAVAIR is concerned that there will be too much on the NAVWAN and that people will suffer from "information overload." Consequently, "what's important is harder to determine. Knowledge is different than information, when there's more to choose from, people don't get the knowledge they need." He adds, "You can get everything from everybody so do you need to answer all of it? The complexity is continually growing."

10. Stakeholder Methods to Overcome Barriers to NAVWAN Implementation

Most of the stakeholders could not think of specific methods to overcome the barriers previously discussed. However, the stakeholders offered some recommendations that may be useful. These recommendations are in four significant areas including financial support, security, training, and promotion of the NAVWAN throughout NAVAIR.

In order to cut the cost of implementation at COMFITWING/COMAEWWING, "we' re going to use coaxial cable instead of fiber because the NIC for fiber is $498 each, while the coaxial cable is only $30 each." COMFITWING/COMAEWWING has sought numerous ways they can save on hardware costs, because he doesn't believe they will need the latest technologies for the LAN/WAN implementation. Although most of his facility already has fiber optic links, he states "they will use coax thin net to hook the terminals up to the fiber because it only costs $0.12 per foot instead of $16 per foot." Although the transmission speed of the LAN is reduced somewhat, he does not think it "will significantly affect the performance of the network for their purposes."

NAESU also suggested a specific measure to trim costs by suggesting that "eliminating travel costs will free up money to put toward the NAVWAN." He figures that they are "currently spending up to $72,000 annually for travel at this detachment. Seventy-five percent of this travel could be reduced through wide area connectivity." He believes that NAVAIR should take some of the funds allocated for travel by all the NAESU detachments. "If you add up the savings from reduced travel by 42 detachments, you could pay for it [the NAVWAN]."

NAESU also states that there will eventually be economies of scale for the NAVWAN users. "As the NAVWAN grows, the cost per user should be reduced, because of the large volume of users it should be fairly inexpensive." Supply disagrees that the number of users at NAS Miramar will continue to grow. "Unless

something changes with the BRAC decisions, I don't see us getting the money to implement it base wide."

NAVAIR disagrees with the above constraint because the Marines who are taking over the base will be able to employ the NAVWAN. NAVAIR doesn't believe that individual funding by the activities is the best solution to the scarcity of financial resources. He says, "Change the doctrine! [Current Budget Regulations] The NAVAIR Comptroller will support the issue of enterprise team funding if we converge [NAVWAN] goals with other team goals . . . boot strapping."

By boot strapping the goals of the NAVWAN with the goals of other projects in NAVAIR, he believes NAVAIR will be able to provide corporate funding for the continued use of NAVWAN in the future. "Presently NAVAIR is funding the prototype Demonstration/Validation Team initiatives, but they may continue to fund it if it is beneficial for enterprise management." His goal is to obtain continued funding for the NAVWAN at the NAVAIR level.

Measures to address security and abuse were recommended by several stakeholders during the interviews. ISSO, NADEP, ADMIN, NAESU, AIMD, NADEP, Supply, and COMFITWING/COMAEWWING all advised restricting access of the NAVWAN and providing strict security policies. Many stakeholders also felt Internet access should also be restricted to anything with an address ending in ".mi"l to signify a military network.

In order to coordinate the NAVWAN implementation, NADEP believes "the end users should also get more consideration and participate in the decision process." He believes "the role of the Automated Information System (AIS) people is to facilitate a cooperative effort and they should be responsible to the users." NADEP is also a strong advocate of more centralized coordination and control and he believes the "rice bowls must be overcome." He adds that "keeping everything separate just makes it all too hard. To be a good service provider, the AIS people must coordinate the AIS services."

NADEP recommends that "we consolidate and centralize things in order to receive the benefits of standardization, like the economies of scale and better configuration management." In his experience "when things are decentralized, the costs are hidden and people don't appreciate the amount of money spent on all these different systems." On the other hand "when the systems and support are centralized, the costs are more visible." He has seen the pendulum swing both ways. "Initially everything was centralized with mainframes, now everything is decentralized with PC's, LANS and their own AIS staff . . . we need to move back to centralization through wide area networks." He views the NAVWAN as the best method to achieve greater centralization.

NADEP wants everyone to "think of the NAVWAN as a utility that everybody needs to use. If you don't follow standards and pay for your portion, it won't work." However, NADEP doesn't believe the Navy should eliminate all the separate systems and put them all under control of one central activity. Even if it is centralized, he questions why all the IS support is ashore. "Why isn't the fleet the priority? They are spending so

much on shore information system support . . . it should all be tied to the fleet." He offers the option of "contracting out all the AIS functions in order to ensure both ashore and afloat AIS needs are met."

NAMO believes the political barriers to the NAVWAN implementation can be overcome with more advertising. "We need to do convincing demonstrations and allow them to replicate them. Once the users have access to the NAVWAN, they will begin to realize its benefits and we won't need to advertise."

"Because they all work with computers now, they will have no trouble understanding the capabilities," is a comment by PSD that is echoed by CNAP, ADMIN, and the Staff Civil Engineer. NAVAIR disagrees because they use computers extensively at NAVAIR yet

> People at NAVAIR don't fully understand it yet. I've briefed it more than 100 times to groups of 20-100 people. It's also advertised in newsletters and other forms of command internal info. People are hooked up and they don't even know it! Part of the problem is education and training and then some people just never get it! There's only so much I can do to advertise and it takes up a lot of my time.

As a member of the Demonstration/Validation Team, it is NAVAIR's responsibility to accurately convey the capabilities of the NAVWAN to the potential users. The NAVAIR representative has worked hard to convey its capabilities and grows frustrated when people don't understand. NAMO feels that "only when they get to use it, will they fully understand it."

All of the stakeholders agree that training will be necessary in some form or another for the users. They are also willing to provide it within their organization or contract service providers to ensure their people receive it. ISSO stated that training is vital because "inexperienced users will clog up the system, so it's better to provide training rather than let them fool around and possibly screw up the system."

The stakeholders expressed several ideas on how to obtain the necessary training. Some, like NAESU, ISSO, ADMIN, and Supply, believe they could train their own people. Others, like the Staff Civil Engineer and COMFITWING/COMAEWWING, want to use outside sources. PSD likes to use a combination of both methods so they intend to send some core people to the training and then use these people to train others. ISSO suggested that the Defense Mega Center should provide training and NAMO suggested a reserve unit.

The only concern about training was finding the time and the manpower. Only CNAP felt their users would not receive training, so they will need to rely on the users manuals. NADEP also recommended a full description of the system, systems guide, users guide, and all documentation be provided. "People will need these for reference purposes, even when training is provided."

C. DIFFUSION OF INNOVATION SURVEY

Following their interviews, the stakeholders were given a survey regarding the diffusion of innovation characteristics. As previously discussed, there are five characteristics of an innovation that can be evaluated to predict the rate of diffusion.

These characteristics include relative advantage, complexity, observability, trialability and compatibility. Definitions of each characteristic are provided in Chapter II.

Using a Likert scale, the stakeholders were asked to rate the level of each characteristic with respect to the NAVWAN. The levels on the Likert scale range from one to five, where a one is low, a five is high, on the given characteristic. As representatives of the stakeholder groups, they were also asked to keep the average user in mind when responding. A frequency distribution is presented in Table 1 to demonstrate the response rates. Because the sample is small, statistical testing is not appropriate; however the results will be interpreted and discussed in Chapter V.

Table 1.

Diffusion Of Innovation Frequency Distribution

	LOW	1	2	3	4	5	HIGH
(1) RELATIVE ADVANTAGE			1		3	8	
(2) COMPLEXITY		1	3	2	5	1	
(3) OBSERVABILTY		3	2	3	2	2	
(4) TRIALABILITY			1	2	1	8	
(5) COMPATIBILITY			1	3	2	6	

V. ANALYSIS

Analysis of the results described in the preceeding chapter was performed using several paradigms addressed in the literature review. These paradigms include the stakeholder framework; weaknesses, opportunities, threats, and strengths model; and the diffusion of innovation characteristics. Additionally, an analysis of the Demonstration/Validation technological change management is provided.

A. STAKEHOLDER FRAMEWORK

1. Stakeholder Map

A Stakeholder map identifies the stakeholders groups who can affect or be affected by the achievement of an organization's purpose. (Roberts, 1989). The purpose of the map is to determine the groups that have the potential to make a difference in the outcome of some course of action. In this instance, the course of action by NAVAIR is to implement wide-area network connectivity at NAS Miramar. This course of action provides the center point for the map. The stakeholders addressed in this thesis are depicted surrounding the issue (see Appendix C). The initial map can be broken down further into general categories of stakeholders including the Demonstration/Validation Team, NAS Miramar Departments, and Tenant Activities (see Appendix C).

An organizational chart is provided in Appendix D. This chart demonstrates location of the stakeholders in the NAVAIR chain of command and their relationship to each other. The reader should note the Demonstration/Validation Team representatives

are located higher in the organizational chart than the NAS Miramar Departments and most of the Tenant Activities. One exception is the NAESU detachment which reports directly to NAVAIR. PSD is the only tenant activity that is not in the NAVAIR organization. However, PSD works closely with NAS Miramar and the Officer-In-Charge is in an additional duty status to the Commanding Officer of NAS Miramar.

The stakeholder maps and organizational chart clearly depict the identity of each stakeholder and their relationship to the group. Understanding these relationships and the organizational perspective on the issue of interest of each stakeholder assists in the analysis of results.

2. Stakeholder Audit

Determining the stakes or issues of each stakeholder is the next step in performing a stakeholder analysis. This determination is made by performing a stakeholder audit. The interview results discussed in the previous chapter provided the data required for the stakeholder audit. The audit was performed in the following fashion. First, the responses to each interview question were reviewed to determine the issue categories for each stakeholder audit matrix. For example, graphics, reduced costs, and future funding are all issue categories. Second, the stakeholder audit matrix topics were determined from consolidation of the issue categories into interview question topics. Barriers to implementation, functional requirement constraints, and NAVWAN training are all stakeholder audit topics. Similar interview questions were consolidated into one audit matrix. Third, each issue category was represented by a column in the appropriate

stakeholder audit matrix. Fourth, the name of each stakeholder was recorded in a row of each stakeholder audit matrix. Last, the stakeholder responses to each issue category were inventoried and recorded in the appropriate block of the audit matrix that corresponds to the stakeholder and the issue category.

While performing the audit, some guidelines were followed in categorizing the responses. If an issue was mentioned by more than one stakeholder, it was included as an issue category in the stakeholder audit matrix for that topic. A response to an issue was included if it was mentioned at the time the question was asked and/or anytime during the interview. If a stakeholder did not address the issue during the interview, that block of the audit matrix is empty. However, an empty block of the audit matrix does not necessarily indicate the stakeholder does not possess a stake in that issue category, only that it was not mentioned at the time of the interview. The stakeholder audit matrices are provided in Appendix E.

3. Stakeholder Analysis

A stakeholder analysis is based on the results of the stakeholder audit. In order to provide a thorough stakeholder analysis of the NAVWAN implementation at NAS Miramar, each stakeholder audit matrix is addressed in a separate subsection. The title of the subsection corresponds with the title of the stakeholder audit matrix.

a. Knowledge of NAVWAN Capabilities

Nine of the twelve stakeholders stated that they had previous knowledge of the NAVWAN capabilities (see Figure 1 of Appendix E). This knowledge was conveyed

to them in a brief presented by the Demonstration/Validation Team in September 1994. During the brief, the initial capabilities of the NAVWAN and its impending implementation were discussed. The initial capabilities include global electronic mail, a comprehensive electronic mail directory, and file transfer across multiple platforms throughout NAVAIRSYSCOM and its subordinate activities. Planned future capabilities include shared databases, global applications, and Internet access.

b. Functional Requirements

Many functional requirements are common to all or a majority of the stakeholders (see Figure2 of Appendix E). For example, all the stakeholders will use the E-mail and File Transfer Protocol (FTP) functionality provided by NAVWAN interconnectivity. They would also like to use the NAVWAN to send and receive unclassified Defense Message System (DMS) traffic. This functionality is not currently provided by the NAVWAN. However, it is possible to coordinate unclassified DMS and transmit it across NAVWAN. In the interim, the increased use of E-mail may reduce the requirement to use DMS.

Applications such as word processing, graphics, and spreadsheets are also required by a majority of the stakeholders. Standardization of these applications across the NAVWAN will significantly improve configuration and document management for all NAVWAN users. Applications on the NAVWAN are currently only available as attachment via E-mail. Standardization of these applications is not yet mandatory.

Bulletin board and real-time database access are other functional requirements that will assist a number of stakeholders. Many commands such as BUPERS and NAESU have bulletin boards for internal and external users to obtain information. Real-time database access is required for access to NAESU personnel administration, aviation logistic support, and aviation maintenance administration databases. Bulletin board and real-time database access are currently available through NAVWAN connectivity. However, many users are either not aware of this functionality or choose not to use it.

Video teleconferencing is used by NAVAIR activities, but it is not available through NAVWAN connectivity. NAVAIR has established a number of video teleconferencing centers where members of different competency aligned teams meet for regular management sessions. The NAVWAN Team is one of the groups that uses video teleconferencing to coordinate team endeavors. However, the existing NAVWAN architecture does not support video teleconferencing. The alternative for these stakeholders is to use the nearest video teleconferencing center at the NADEP on NAS North Island.

c. NAVWAN Interconnectivity

From the NAVWAN interconnectivity audit, the stakeholders clearly demonstrate the need to communicate with activities throughout the Navy and DOD (see Figure 3 of Appendix E). With the increased DOD emphasis on joint service endeavors, it would be beneficial to provide access to the entire military network via NAVWAN.

Nearly every stakeholder could cite DOD activities outside the Navy with whom they would like to communicate. Many stakeholders also believe it would be beneficial to provide Internet access via the NAVWAN. Communication with commercial contractors and research institutions are essential for mission accomplishment by many stakeholders including the Staff Civil Engineer, Supply, NAESU, NADEP, NAMO and NAVAIR.

Wide-area connectivity is tentacular in nature and consequently difficult to manage. However, wide-area network operating systems make it conceivable. Considering many of the stakeholders interviewed currently have no wide-area connectivity, the extent of their initial connectivity may be very limited. However, once they have connectivity to even a limited extent, their connectivity requirements may continue to expand. The difficult question for NAVAIR is how far are they willing to extend NAVWAN connectivity? Because some stakeholders, like NAMO, already have Internet access, it may benefit all the stakeholders to have it.

d. Benefits of NAVWAN Interconnectivity

There are numerous benefits to NAVWAN connectivity. Those most commonly cited by the stakeholders are included in Figure 4 of Appendix E. Every stakeholder mentioned increased time savings as a result of faster communications and reduced delays in responses. Because of this, many stakeholders believe customer service and productivity of the users would improve. Easier access to centralized corporate databases and improved integrity of those databases will make them more effective and efficient tools for all the users. Many users believe NAVWAN use will lead to

standardized NAVWAN applications and improved configuration management. Once everyone has access, NAVWAN use will result in reduced reliance upon DMS. It may also lead to consolidation of IT personnel and existing systems that will eventually reduce costs.

The aforementioned benefits are only a few of those mentioned by the stakeholders. Greater details of these benefits can be found in the interview result section of the preceding chapter. Quantitative benefits can be determined from the reduced costs due to communication line consolidation, elimination of existing systems, reduced DMS use, better inventory management through improved database integrity, and economies of scale in purchasing hardware, software, and services. Above and beyond the quantitative benefits, there are many qualitative NAVWAN benefits for example improved communication and customer service. These can also be used to justify the system and its continued growth. The economic value of the qualitative benefits may not be precise, but they do provide added value to the users. The extent of this added value would depend on the individual user and the situation.

e. Functional Requirement Constraints

There are limitations to the NAVWAN that will constrain stakeholders in achieving their functional requirements (see Figure 5 of Appendix E). Because stakeholder functional requirements are met now by existing systems, there is resistance to using new technologies. Stakeholders rationalize that the existing systems are sufficient for their needs, more secure than the NAVWAN, and the users are already familiar with

their use. Since the NAVWAN is not extended to everybody in the Navy, it is perceived that duplication of effort will occur from employing both the NAVWAN and existing systems to ensure communication is received by those who are connected to the NAVWAN and those who aren't. Furthermore, the stakeholders are concerned that NAVWAN cannot be used if the information is classified or sensitive because it is not secure.

Some stakeholders have technical limitations that reduce or prevent NAVWAN connectivity with their existing architecture. COMFITWING/COMAEWWING and NAESU simply do not have the network infrastructure to support wide-area connectivity. ISSO states that NAS Miramar LAN infrastructure does not have the speed or performance capability of the NAVWAN. Therefore, any link in connectivity is only as strong as the weakest or poorest performing link.

Other stakeholders have networks, but failure to standardize operating systems and applications will prevent them from complete interconnectivity. An arena where they can all communicate is the Internet. However, restricted Internet access will limit the connectivity of some users who want to communicate beyond the scope of the MILNET. Meanwhile, other stakeholders want to keep users from surfing on the Internet or using the NAVWAN to circumvent the chain of command.

These constraints must be evaluated and overcome by the Demonstration/Validation Team and/or the stakeholders in order to realize the full

NAVWAN potential. None of these constraints are insurmountable and most can be overcome through careful planning and management of the implementation process. This implementation process should include infrastructure standardization, policy guidance, and comprehensive training on the capabilities and limitations of the system. More specific recommendations for eliminating these constraints will be addressed in Chapter VI.

f. Barriers to Implementation

Commonly addressed barriers to the NAVWAN implementation are found in Figure 6 of Appendix E. These barriers include concerns over future funding, resource limitation, political issues, information overload, security, and false expectations. None of the barriers were addressed by every stakeholder and each stakeholder offered methods to overcome these barriers. The methods to overcome the barriers to implementation are addressed in the next section.

Future funding of the NAVWAN is questionable at NAS Miramar because of the Base Realignment and Closure (BRAC) decision to convert the base into a Marine Corps Air Station (MCAS). NAVAIR is funding the initial NAVWAN gateway to NAS Miramar, but NAVAIR will not fund any base infrastructure. BRAC has severely limited NAS Miramar funds and the fate of the tenant activities is questionable. Some tenant activities may remain at NAS Miramar, while others will be relocated. Consequently, NAVWAN implementation at NAS Miramar will be limited to the capabilities of the existing LAN infrastructure unless funds are made available to build it.

NAS Miramar has limited IT personnel resources to support the existing

infrastructure. They do not have the time or expertise to support the NAVWAN implementation. The issue of scarce resources and limited funds is also a barrier for the Demonstration/Validation Team. NADEP summed up the situation when he stated "the tools to get to implementation are scarce because internal priorities overcome external priorities." At the NAVAIR level, NAVWAN implementation is the responsibility of an Enterprise team consisting of different smaller teams of people at locations throughout NAVAIR. For example, the Demonstration/Validation Team is part of the NAVWAN Implementation Enterprise Team. In this case, stakeholder interviews suggest it is difficult for the Demonstration/Validation Team to obtain the necessary technical resources because these resources are primarily dedicated to the endeavors of the competency aligned teams at their internal locations, not to external enterprise endeavors such as the NAVWAN implementation.

An unwillingness to share IT personnel, financial, and infrastructure resources between Enterprise and competency aligned teams creates political barriers to the NAVWAN implementation. The politics of this joint effort were repeatedly mentioned by the stakeholders as a barrier to implementation. Some referred to these politics as "rice bowling" and others as "empire building." "People want to maintain control of their systems . . . It's a power issue!" stated NADEP. Yet NAVWAN implementation requires a commitment of resources by all organizations that desire connectivity. It also requires a willingness to give up some control of their LAN, in order to receive the benefits of the

WAN. Until these benefits are fully appreciated, some stakeholders may be reluctant to implement NAVWAN.

Stakeholders are also concerned that users will abuse wide-area connectivity. Surfing on the Internet and writing E-mail all day to friends are two of the most commonly mentioned methods of abuse. NAVAIR explains that some abuse initially is part of the learning curve. "Imagine the learning curve for NAVWAN is S-shaped . . . Initially they won't use it much, then their use increases dramatically, but eventually it will tapper off to a stable level of use." He believes some abuse as the users become familiar with the system is expected, but that this abuse or testing the system is necessary. NAMO agrees with NAVAIR's evaluation and feels the stakeholder concerns about NAVWAN abuse are unfounded. He states, "Playing around with the system is part of learning how to use it . . . nobody really abuses it."

A greater barrier for some stakeholders is that the NAVWAN will be used too much for mission accomplishment. These stakeholders fear information overload, because everything is on the system. NAVAIR is currently experiencing this phenomenon. He has more E-mail than he could possibly read. Because of information overload, he states that "what's important is harder to determine." He points out, "Knowledge is different from information, when there's more to choose from, people don't get to knowledge they need." He adds, "You may get everything from everybody . . . so do you need to answer all of it? The complexity is continually growing." Some users may or may

not be able to manage the growing scope and complexity of the NAVWAN once it is implemented.

Along with the growing scope of the NAVWAN are increased Internet security risks. Once the NAVWAN is connected to the Internet, it becomes open for intrusion. NADEP thinks the greater threat of abuse is from outsiders. "We are evaluating firewalls and filters, not necessarily to keep people from going out, but to keep other people from coming in." At COMFITWING/COMAEWWING "computer phobia that is out of control." In this stakeholder's opinion, "everybody is freaking out about hackers." As a result, he believes "it is important to practice computer security measures, use access matrices, have two system administrators, close obvious holes, and perform virus checks to and from the servers at all times."

Ultimately, there are many false expectations about the NAVWAN that are both positive and negative. "The response to the initial concept is very positive and they are all very supportive," is the sentiment of the NADEP representative. But he added, "then the reality of the implementation is less than glowing." From his experience, the expectations of the users are not being met and that people have a lot of false expectations because they don't fully understand the capabilities. "They are also disappointed in the time line and there is an expectation of deep pockets that really aren't there."

Although the stakeholders state that they understand the capabilities of the NAVWAN, unrealistic expectations by the users are a concern for the NAVWAN Demonstration/Validation Team. When these expectations are not met, users express

disappointment and frustration. "The functionality that they want just doesn't happen over night . . . They need to be patient with us," stated NADEP. According to NAVAIR, "They think they understand the capabilities, but they can't, because we're not even sure what we will be able to do, once we get it up and running." Therefore, the true capabilities of the NAVWAN will not be understood until it is implemented and tested.

ISSO explains that some of the unrealistic expectations are attributable to the growth of commercial Internet access. He states that, "people who know about it are excited, but they equate it with CompuServe and Prodigy software." He also warns that the users are not entirely familiar with the NAVWAN, "they just think they are." During one NAVWAN introduction brief, the Commanding Officer of NAS Lemore stated, "Wow! Does this mean I can now get CompuServe at my desk?" Clearly, there are some unrealistic expectations of the NAVWAN capabilities and interfaces that need to be addressed.

g. Methods to Overcome the Barriers to Implementation

Stakeholders offered several methods to overcome the barriers to NAVWAN implementation (see Figure 7 of Appendix E). These methods include measures to reduce costs, provide training, improve configuration management, increase security, and change attitudes. These ideas did not necessarily address all the barriers to implementation, but they are initial steps the Demonstration/Validation Team should consider.

Reduction of IT costs is a goal of nearly every stakeholder. Consequently, the Demonstration/Validation Team has pursued several measures that may reduce the stakeholder IT costs or make funds available for the NAVWAN implementation. NAVAIR corporate or enterprise funding is one method the Demonstration/Validation Team is proposing to overcome the barrier of limited financial resources and uncertain future funding. They have also investigated the utilization of existing dedicated communication lines. Because these dedicated lines are clearly underutilized, they have recommended consolidation or elimination of the dedicated lines for additional cost savings. This may also mean elimination of existing systems whose functional requirements can be incorporated into NAVWAN. Lastly, they advocate centralization of IT personnel to ensure their best utilization during the implementation and for continued support.

Education about the NAVWAN benefits and capabilities is the method offered by nearly all stakeholders to overcome the political issues. Standardized training that is widely available to the users is their answer to the barrier of resistance to change from existing systems. With the appropriate training and policy guidelines, abuse of the system may be less likely. Training and policies will be easier to implement if applications and interfaces are standardized.

Training should include demonstrations of all the NAVWAN capabilities. This is thought to be the best way to expel false expectations. Because the users have not seen it, they have nothing to compare it to, except other commercial wide area network products. Once it is implemented, understanding of the capabilities should increase.

However, training will be necessary to ensure that users exercise the capabilities available. ISSO states, "Now that they have it, they will want to know what to do with it. Since it's not intuitive, they will need a quick start version with an easy interface." At the present time, no specific interface is provided, because the users will employ their current LAN E-mail system and only the addressing will change. Yet there is added functionality with the NAVWAN. File transfer, global directory and real-time database access are new capabilities for the users and these capabilities will increase as the NAVWAN evolves.

As the NAVWAN evolves it may include Internet access which will increase security risks. An effective security plan that reduces these risks was recommended by several stakeholders. In the plan, stakeholders recommended nearly every security measure possible, including central security administration, passwords, access matrices, firewalls and encryption capabilities. As the security of the network increases, the accessibility and performance of the network may be decreased. The tradeoffs between these measures, their effectiveness, impact on accessibility, and cost to implement must be weighed by the Demonstration/Validation Team and the stakeholders.

Despite the barriers to implementation, the prospective users are very excited about its impending implementation. This positive attitude may be enough to fuel the interest of other users to at least test the system. The more users who test the system and learn to use it, the more likely NAVWAN use will spread. To some stakeholders, attitude is everything and their users can't wait to use it. An example of this enthusiasm is the Supply Department where "They love it and can't wait to get it". Everybody is asking

Supply about it, "When will it be on line? When can we start using it?" This stakeholder is continually bombarded by people in his organization who can't wait to have access to the NAVWAN.

h. Training

Before these users have access to the NAVWAN, they will need some training (see Figure 8 of Appendix E). This training can be provided by the stakeholder command, by other sources, or a combination of both. Only CNAP did not think training could be provided. All the other stakeholders plan to provide training to their users.

B. WEAKNESSES, OPPORTUNITIES, THREATS, AND STRENGTHS MODEL

Based on the stakeholder analysis, the weaknesses, opportunities, threats and strengths of the NAVWAN implementation can be readily identified. It is important to note that the NAVWAN strengths and weaknesses are inherent to the system, while the opportunities and threats are external to the system. Combined, they provide a concise indicator of the implementation environment. Although the weaknesses, opportunities, threats, and strengths analysis could incorporate most of the issues identified by the stakeholder analysis, only those aspects not previously discussed are addressed in this section. (See Appendix F.)

1. Weaknesses

NAVWAN has some inherent weaknesses that must be compensated for by strengths or overcome by opportunities. The initial infrastructure of the NAVWAN is

very weak. This infrastructure consists of resources used by more than one information system including hardware, software, data, processes and people. To support full deployment of the NAVWAN, sufficient infrastructure must be built to sustain its operations. With multiple architectures, it is difficult to build the quality of infrastructure necessary for maximum performance.

Each architecture requires its own technical specialists and training for users. With multiple architectures and interfaces, standardized training cannot be provided. Users must then rely on local training sources who may not be familiar with all the capabilities of NAVWAN. Therefore, users may be limited by their local interface and never realize the full potential of NAVWAN. Because there is little supporting documentation and no user's guides, there are no reference tools available. Furthermore, NAVWAN does not have any utility or help desk services. These weaknesses combined with the lack of technically proficient personnel may undermine the NAVWAN implementation before it starts.

2. Opportunities

Fortunately, multiple opportunities exist to facilitate NAVWAN implementation. NAVAIR enterprise funding will overcome significant cost constraints and concerns about future funding. Enterprise funding is also best for centralized system administration and management of the system. A wide-area network operating system will be required to provide centralized system administration. Centralized funding and system management

could also pave the way for centralized IT assets. With centralization, economies of scale can be achieved in purchasing hardware, software, and services.

Once the NAVWAN is in place, it can also be used to manage decentralized processes. The reorganization of NAVAIR into competency aligned teams at multiple locations requires a common mode of communication. The implementation of a powerful, robust infrastructure adds options that allow innovative functions not even availble to weakly infrastructured activities. If NAVAIR builds a more powerful infrastructure, they can exercise more options. For example, virtual project management of efforts at multiple locations is possible because of wide-area connectivity. Internet access to commercial vendors, research labs, and test/development locations may also improve NAVAIR project management.

Improved security and performance of the NAVWAN will also lead to elimination of existing systems. For example, a secure NAVWAN could eliminate the need for DMS, fax machines, and modems which may be cost saving opportunities. As existing systems are eliminated, funding for existing systems and communication lines can be consolidated into NAVWAN funding. However, the expectation of cost savings must be realistic because the cost of some existing systems and communication lines may be difficult to identify and recover.

Internet access does create security risks, but centralized system's management can reduce the risk through increased security. Specifically, centrally located gateways to the Internet can be monitored by firewalls. When Internet gateways are established, use of

firewalls at the local and global levels provides multiple levels of security. Packet filtering firewalls can help deter intruders by denying access from untrusted network addresses and protocols.

Individual sites may want to further increase their security by employing application gateways between their NAVWAN router and the LAN host. These application-specific firewalls will screen access to the host server and act as an application proxy for the host. However, these security measures increase the complexity of NAVWAN for the users and reduce their accessibility to the system.

The use of pre-authentication devices, such as smart cards and retinal scanners, is another security measure which could be employed. In the near future all DOD identification cards will contain a memory chip that contains personal information that can be used to restrict or permit access to security systems. When coupled with password systems, they provided added security to the system. (Bower, 1994)

Another security measure which could be a significant opportunity for NAVWAN is to implement network encryption systems (NES) that encrypt sensitive or secure data from classified LANS. The NES is placed between the NAVWAN router and the classified server and encrypts and decrypts traffic that passes from the classified LAN to the WAN. This optimizes the use of the WAN without compromising the security of the LAN.

As the NAVWAN develops, it may also be possible to develop a charge-back scheme to recoup some of the costs of implementation and continued operations.

Ultimately, the evolutionary nature of the NAVWAN will continue to provide opportunities for expansion and enhancement while capitalizing on the existing infrastructure.

3. Threats

From the NAS Miramar perspective, the BRAC decision to change NAS Miramar to an MCAS is a significant threat to NAVWAN implementation. However, NAVAIR will include the MCAS in their connectivity requirements. Consequently, NAVAIR does not believe extending the NAVWAN to NAS Miramar is a poor investment because it will be used by Marine aviation activities.

The threat at NAVAIR is the loss of their champion, VADM Bowes, who believed wide-area connectivity was essential for their competency aligned organization to communicate. VADM Bowes transferred from the command recently, and the fate of the NAVWAN in future budgets is questionable. Consequently, the Demonstration/Validation Team is working as quickly as possible to successfully implement the NAVWAN at prototypes to demonstrate its capabilities.

Another threat to NAVAIR's NAVWAN initiative is the Defense Information Systems Agency (DISA). In their effort to provide wide-area connectivity throughout DOD, DISA may assume control of this endeavor. Because the task of providing wide-area networking to DOD is so monumental, DISA may simply absorb the WAN initiatives of all the components within DOD. Striving to gain enterprise control of IT development in DOD, they do have the authority to usurp control of the NAVWAN. If DISA assumes

control of the NAVWAN, the politics of a joint effort at the NAVAIR level would be magnified to a greater degree at the DOD level.

Beyond DOD, there is definitely a threat from Internet intruders. These intruders may just be curious hackers who are trying to explore DOD networks, or they could have malicious intent. On a larger scale, these intruders could expose information warfare vulnerabilities. Keeping intruders out is a serious threat that must be addressed before NAVWAN is fully deployed.

4. Strengths

There are many strengths to the NAVWAN implementation. First, NAVWAN will provide wide-area connectivity throughout naval aviation. Additionally, NAVAIR is at the highest levels of the chain of command and they are sponsoring the imitative. This sponsorship includes funding, installation, and support of NAVWAN gateways. Using existing architecture, they improve communications through E-mail, FTP, directory services, and connectivity throughout NAVAIR. They are committed to the endeavor and are pushing the technology.

NAVAIR also benefits because NAVWAN permits access to shared databases and applications. Real-time database access improves the integrity and performance of existing aviation maintenance and logistics information systems. Increased access to logistics information and improved reliability of this information ultimately increases the readiness of aviation units that rely upon these systems for parts and supplies.

C. DIFFUSION OF INNOVATION CHARACTERISTICS

Diffusion of innovation characteristics can be used to predict the rate at which NAVWAN use will spread throughout. The results of the survey provided to the NAVWAN stakeholders at NAS Miramar are provided in Table 1 of Chapter IV. From these results, certain indicators of NAVWAN diffusion can be determined.

1. Relative Advantage

NAVWAN's relative advantage over other systems is perceived by most of the stakeholders to be very high. Some stakeholders noted the relative advantage is somewhat limited because existing systems are already being used to achieve their functional requirement so they may not perceive a greater advantage to using NAVWAN. Only one stakeholder did not see much of a relative advantage to the system because it does not yet include Internet access. If Internet access was available via NAVWAN, the relative advantage would increase for those stakeholders that evaluated relative advantage at lower levels.

High relative advantage perceptions by the stakeholders will increase the diffusion rate of the NAVWAN. Adding functionality that is not currently available through existing systems is one method that may increase the relative advantage. Elimination of existing systems and consolidation of these functions into the NAVWAN may also increase NAVWAN's relative advantage. Internet access is one functionality that is not currently available to the stakeholders. If Internet access was offered through NAVWAN connectivity, the perceived relative advantage of NAVWAN would increase.

Consolidation of existing functionality, such as DMS capability will also improve the diffusion rate.

2. Complexity

NAVWAN complexity is perceived to be rather high by a majority of the stakeholders. For the Demonstration/Validation Team, the perceived complexity of NAVWAN was much lower than some of the stakeholders who had not yet used it. Because most of the stakeholders have not had an opportunity to use the NAVWAN, the complexity was difficult for them to determine. Some stakeholder users are more computer literate than other stakeholder users. Consequently, NAVWAN complexity is perceived to be higher for the stakeholders whose users are less computer literate.

Higher perceived complexity will slow the diffusion rate of NAVWAN. Measures should be taken to reduce the complexity of the system in order to achieve maximum diffusion of the system throughout NAVAIR. User friendly interfaces such as those offered by Windows was the suggestion of one stakeholder. The Demonstration/Validation Team would also like to include utility services and a centrally located help desk to assist users in overcoming NAVWAN complexity.

3. Observability

Stakeholders were not in agreement about the observability of NAVWAN. Only two stakeholders believed their users could watch someone else use the NAVWAN and then use it themselves. One suggested that observability could be used in training by presenting the interfaces on a large screen in front of a class and allowing the users to

follow the actions of the users on their own screens. Another stakeholder believed you could watch someone perform a function on their screen and then do it on your own; but this would be limited to a few functions. Some stakeholders also thought simply watching others use NAVWAN successfully would increase interest and prompt potential users to try it. Furthermore, discussion and comments by satisfied users will spread diffusion.

High perceived observability increases the rate of diffusion, but the results on this characteristic are across the survey ratings spectrum. However, it is possible to improve the observability by employing some of the methods suggested by the stakeholders. Furthermore, observability in an active sense as an observer may difficult to apply to this innovation because NAVWAN is primarily used on an individual basis. Yet, passive observability through discussion and advertising NAVWAN benefits is applicable and can be used to spread diffusion. As one stakeholder said "When somebody is sitting in front of the screen, you really can't see what they are doing . . . you need to try it out yourself!"

4. Trialability

Testing the innovation for yourself is referred to as trialability. If the risks of trying the innovation are minimal, people are more willing to test the innovation. When trialability is high, diffusion spreads faster. In this case, the perceived trialability is rather high. Many stakeholders believed they could easily test NAVWAN's capabilities and the risks would be minimal. Some were concerned that there would be some consequence of "screwing up the system," but most did not see any problem testing it. Because many stakeholders already use computer systems, they believe NAVWAN will be learned via

trial and error like other systems. This high level of trialability will certainly increase NAVWAN diffusion.

5. Compatibility

For the stakeholders whose users currently employ information technology, NAVWAN compatibility is perceived to be very high. These computer literate users will have no problem incorporating NAVWAN in their organizations and look forward to having it because it is technically and functionally compatibility with their current work. Stakeholders whose users do not currently use information technology to accomplish their mission, do not perceive the NAVWAN to be compatible with what they currently do.

The higher perceived compatibility of an innovation, the quicker it will diffuse. Compatibility can be increased by demonstrating how NAVWAN can assist users in performing their mission. For example, providing technical publications via the NAVWAN may increase NAVWAN compatibility for aviation maintenance technicians. Three dimensional graphics and designs may also be necessary to increase NAVWAN compatibility for NAESU engineers. Ultimately, compatibility can be increased through increasing functionality to address user requirements.

D. MANAGEMENT OF TECHNOLOGICAL CHANGE

NAVWAN implementation at NAS Miramar is a significant technological change for the stakeholders involved. Implications of this change are identified in the stakeholder audit. Several change themes surfaced from the stakeholder analysis. These themes result in a resistance to change due to parochial self-interest, low tolerance for change,

misunderstanding and mistrust. This resistance to change can undermine the implementation process. Therefore, strategic management of sources of resistance is imperative for successful implementation of the NAVWAN.

There are several measures the Demonstration/Validation Team are using to manage the technological change process. First, they apprised the prototype sites of the impending implementation. The Demonstration/Validation Team accomplished this by briefing all significant stakeholders at the prototype locations about the NAVWAN and its capabilities. Second, they are including stakeholder representatives as members of the implementation team. Next, the Demonstration/Validation Team facilitated several user group meetings at the prototype sites during the implementation process. During these meetings they addressed user concerns and future functionality including Internet connectivity. Last, the Demonstration/Validation Team assured the stakeholders of their plans to provide continued technical and financial support for the NAVWAN initiative until it is up and running on a routine basis.

Clearly the NAVWAN Demonstration/Validation Team is facilitating this technological change by providing continued support. However there are some contentious issues that have not been resolved. Funding beyond the first year of implementation is still being negotiated. The stakeholders and the Demonstration Validation Team mutually support enterprise funding of the project throughout NAVAIR, but no agreement has been determined to date. Additionally, no charge back mechanisms for services provided by NAVWAN have been proposed. Nor have the issues of

maintenance and administrative support been resolved. Outsourcing of these functions is a possibility, but funding has not been identified. These issues will be resolved in time, but continue be obstacles to NAVWAN implementation until they are settled.

Because the NAVWAN implementation had not yet occurred at the prototype site, the amount and basis for resistance to change are still difficult to determine. The stakeholders could only evaluate their anticipation of resistance. Continued use of the aforementioned strategies for managing resistance to change is therefore recommended until NAVWAN use becomes commonplace. These change management strategies include communication and education of users, participation and involvement of resistors, facilitation and support by IT personnel, and negotiation between the users and the Demonstration/Validation Team until agreement is reached on issues such as financial support and network management.

If resistance to change grows, other change management practices may be helpful. Continued communications and advisories to all stakeholders on the status of the implementation project and increased functionality will improve user understanding of the implementation process. Standardized training on NAVWAN capabilities throughout NAVAIR may help to eliminate fear of this new technology and improve understanding of its capabilities. Participation of users, beyond the stakeholder representatives, in NAVWAN deployment may also fuel the diffusion process.

Once the system is deployable, involvement of the senior levels of the chain of command will provide champions of the system throughout NAVAIR. Continued

guidance and improved functionality will increase the enterprise value and activate diffusion. Ultimately, financial and technical support by NAVAIR to include network management, systems maintenance, help desk services, and utilities will facilitate use and support NAVWAN users in overcoming many obstacles.

The amount of resistance and the effectiveness of their change management strategy cannot be completely determined until the full NAVWAN implementation at the prototype. Following the implementation, the Demonstration/Validation Team should continue to monitor the change process and adjust the strategy accordingly. If there is greater resistance to change, the Team may want to employ some additional measures. These include increased communication, extensive training, support from the chain-of-command, financial support, and technical assistance. With an effective change management strategy, every source of resistance can eventually be overcome.

E. SUMMARY

Each paradigm used in the analysis of results provides a focused perspective on the implications of the NAVWAN implementation at NAS Miramar. The stakeholder map depicts the significant stakeholders in the NAVWAN implementation at this prototype site. The stakeholder audit is a thorough inventory of the interests of each stakeholder concerning the focal issue. Analysis of the stakeholder audit reveals siginificant functional requirements, benefits, and constraints of NAVWAN implementation. It also indicates the barriers to implementation and the recommended stakeholder methods to overcome these barriers.

Beyond the stakeholder analysis, the results can be focused even further using the WOTS-UP model. A summary of the internal strengths and weaknesses and the external threats and opportunities is provided in Appendix F. This summary graph provides the status of the NAVWAN at a glance. As the NAVWAN evolves, this status will change. To increase the likelihood of successful implementation, the strengths should increase and eventually overcome or adequately compensate for the weaknesses. The probability of success can also be improved by capitalizing on the many opportunities and eliminating the threats.

As NAVWAN use increases, the likelihood of full deployment of the system also increases. Successful implementation at the prototype sites will prove NAVWAN's potential for other locations. Consequently the Demonstration/Validation Team is striving to increase the rate of NAVWAN diffusion. By focusing on the diffusion characteristics, the Demonstration/Validation Team can improve the perceived characteristics that inhibit diffusion and capitalize on the characteristics that excelerate diffusion.

The Demonstration/Validation Team is also striving to manage the implication of technological change. By continuing to employ these strategies, they can identify potential sources of resistance and employ additional strategies as necessary. These approaches as well as those suggested to capitalize on the diffusion characteristics will contribute to enhanced strengths and opportunities and dimished weaknesses and threats.

Ultimately, these paradigms and change management strategies can be employed to evaluate the NAVWAN prototype. The objective of the prototype is to continually refine

the implementation process. Evaluating and understanding a myriad of implications can be difficult without some analytical tools. Although the stakeholder approach may not be the only suitable paradigm, it does provide a foundation for assessing implementation status and formulating appropriate action plans. Conclusions and specific implementation recommendations are addressed in the next chapter.

VI. CONCLUSION

A. INTRODUCTION

Successful NAVWAN implementation at NAS Miramar and throughout NAVAIR is dependent upon the cooperation and support of key stakeholders. The importance of stakeholders in the success of new technology is recognized by Gerald M. Hoffman. In his book, *The Technology Payoff: How to Profit With Empowered Workers in The Information Age* (1994), he recommends that managers change the definition of IT success to "meeting the needs of all the stakeholders."

In order to meet the needs of stakeholders, you must first identify who they areand their needs and interests concerning the target issue. With this knowledge, an enterprise IT vision can be established. At NAVAIR, that vision is the ability of any user in NAVAIR to be able to communicate via E-mail with any other user in NAVAIR regardless of the software, operating system, or location. This vision includes file transfer and directory services for all users. This IT vision was chosen for implementation because most of the organizations within NAVAIR were successfully using E-mail on their LAN and VADM Bowes believed it was a functional requirement for managing competency aligned teams at multiple locations. NAVAIR people already excel in using E-mail on their LANs. Additionally, part of NAVAIR's IT strategy was to realize the full potential of existing systems. To meet the needs of multiple stakeholders and conform to this strategy, they built upon a foundation of their existing architecture and added functionality that every user can employ. Ultimately, this strategy facilitates user "buy in" to NAVWAN implementation.

Once the users bought into the idea of wide-area network connectivity, their prospective functional requirements expanded. These other functional requirements should be considered for future development. However, future development requires a significant commitment of enterprise resources including people, money, and time. Obtaining these resources may be difficult without a NAVWAN champion at NAVAIR. More importantly, the existing IT infrastructure within NAVAIR will not support all the foreseeable information technology needs. Therefore, NAVAIR must decide to either continue and expand its support or to abandon the initiative.

B. IMPLEMENTATION PLAN RECOMMENDATIONS

If NAVWAN implementation is going to continue, there are several recommendations for full scale implementation. These recommendations are based on the results and analysis addressed in this thesis. They are also founded on a definition of success prescribed by Hoffman (1994). The stakeholders will strongly influence the NAVWAN implementation process. Failure to meet their needs, could result in failure of the entire system. Consideration of the following critical and management recommendations in the implementation plan will ensure their needs are met.

Table 2.

Critical Recommendations

- **Identify NAVWAN Champion**
- **Invest Resources Necessary To Build Effective Infrastructure**
- **Dedicate Future Financial Resources**

1. Critical Recommendations (See Table 2)

a. Identify NAVWAN Champion

It is imperative to find and educate a powerful champion of NAVWAN who will commit the resources necessary for complete development, deployment, and maintenance of NAVWAN. Management of change, as outlined throughout this thesis requires a change agent or champion of the change process. As a result of VADM Bowes assignment to a different billet, he can no longer champion NAVWAN implementation throughout NAVAIR. Therefore, a new champion must be identified to continue implementation. This champion must recognize that NAVWAN is an integral part of the NAVAIR reorganization and essential for effective management of dispersed competency aligned teams. If NAVWAN fails, seamless communication across this matrix organization cannot occur.

b. Invest Resources Necessary To Build Effective Infrastructure

The champion should also ensure the Demonstration/Validation Team has the resources necessary to build NAVWAN infrastructure. These resources include the enterprise funding, technical personnel, and support for deployment and evaluation of the system. To assist the Team with NAVWAN management, a wide-area network management system should be implemented and managed by a centralized system administration at the Patuxent River and China Lake hub locations. Performance metrics should be used at these system administration sites to ensure maximum efficiency of the

system. Redundancy and backup support should also be performed by the network administrators to reduce the risk of network failure.

c. Dedicate Future Resources

NAVAIR must ensure NAVWAN infrastructure is not starved for funds or personnel resources as it evolves. Without continued funding and support, the evolutionary process will stagnate. NAVWAN development is only in its infancy, but the evolution of the system is already threatened. Because NAVAIR has made a significant investment in the project, it would be unwise to curtail it until the benefits are fully realized.

Table 3.

Management Recommendations

- **Perform Thorough Cost/Benefit Analysis**
- **Continue Implementation Including Multiple Stakeholder Perspectives**
- **Implement and Enforce Comprehensive Security Plan**
- **Centralize NAVWAN Network Administration, Support and Maintenance**
- **Plan and Standardize Future Infrastructure**
- **Provide Continual Training for Users and IT Personnel**
- **Advertise NAVWAN Strengths and Capabilities**

2. Management Recommendations (See Table 3)

a. Perform Thorough Cost/Benefit Analysis of NAVWAN

A thorough cost/benefit analysis will help to convince the champion of the added value of wide-area connectivity throughout NAVAIR. This analysis should address both qualitative and quantitative benefits along with cost savings. Determination of these benefits should draw on information from the stakeholder audit where qualitative benefits such as contribution to mission accomplishment and improved customer service are defined. Cost saving measures include consolidation of existing systems and communication lines, real-time database access, and shared applications across NAVAIR. More efficient use of IT assets and improved readiness of Fleet units should also be addressed. Ultimately this analysis will more clearly demonstrate the value added to NAVAIR as NAVWAN evolves.

b. Continue Implementation Including Multiple Stakeholder Perspectives

Organizations that effectively manage stakeholder interests and needs are more successful in mission accomplishment. As demonstrated by the stakeholder analysis, there are multiple stakeholders in the implementation of NAVWAN throughout NAVAIR. Understanding the perspectives of multiple stakeholders and incorporating stakeholder needs in the implementation process facilitates diffusion. Consequently, stakeholder representative should be included in any future implementation efforts and their interests should be addressed in all implementation plans.

c. Implement and Enforce Comprehensive Security Plan

A comprehensive security plan must also be devised and implemented to further reduce NAVWAN vulnerability. This security plan should address several security measures to be taken at the system administration level and the local level. Strict policy guidance must be provided and all users mandated to conform to support those who seek to maintain the integrity of the infrastructure. Therefore, there must be strict enforcement of security procedures and serious consequences for those who fail to comply.

d. Centralize NAVWAN Network Administration, Support, And Maintenance

Centralized system administration should provide centralized NAVWAN support and maintenance. Documentation, users' guides, and policy guidance should be promulgated by the system administration centers. Help-desk services for users and trouble shooting consultants for LAN administrators should be readily available. NAVAIR should recognize that IT is different from other support activities and that it requires a significant commitment of resources. This commitment includes 24 hour operations and support to ensure it meets the needs of the users.

e. Plan and Standardize Future Infrastructure

NAVWAN evolution and future infrastructure investments must be planned and standardized. This infrastructure should include an open architecture and conformance with the existing operating systems and platforms. Recognizing the limitation of the System Development Life Cycle (SDLC), NAVWAN development methodologies should improve upon SDLC by employing other methodologies such as

rapid prototyping, integrated computer aided systems evaluation (I-CASE) tools, and joint application development (JAD) approaches. Outsourcing of system development efforts and continued systems operations should also be evaluated. Ultimately, NAVAIR should strive to create an effective infrastructure that will support all their foreseeable information needs. This will require strategic and finanacial planning for all future development efforts.

f. Provide Continual Training for Users and IT Personnel

NAVWAN users and information technology people must be trained to employ and work in the application/infrastructure environment. Without training, the users cannot be expected to effectively use the system and IT personnel cannot be expected to efficiently manage it. Training increases diffusion characteristics such as observability, triability and relative advantage. Training also reduces resistance that results from individual concerns that they have inadequate skills to be a successful user of new systems. This training should occur on a continual basis, especially when functionality is increased with new capabilities. The rapid pace of technological advances requires continual training for IT personnel who will be evaluating new technologies that will permit further NAVWAN evolution. This continued training for both IT personnel users will pave the migration path from existing stovepipe LANS to a fully integrated and comprehensive NAVWAN infrastructure.

g. Dedicate Future Resources

NAVAIR must ensure NAVWAN infrastructure is not starved for funds as it evolves. Without continued funding and support, the evolutionary process will stagnate.

NAVWAN development is only in its infancy, but the evolution of the system is already threatened. Because NAVAIR has made a significant investment in the project, it would be unwise to curtail it until the benefits are fully realized.

h. Advertise NAVWAN Strengths and Capabilities

The Demonstration/Validation Team must continue to advertise NAVWAN strengths and capabilities throughout NAVAIR. Their efforts will increase the passive observability diffusion charateristic and thereby accelerate diffusion. Although the Demonstration/Validation Team has had several user meetings, NAVWAN capabilities should be publicized more to potential users. Training, information directives, and regular updates about the status of NAVWAN implementation and added capabilities should be promulgated by NAVAIR on a regular basis.

C. FURTHER RESEARCH

NAVWAN implementation is far from complete and there are several areas for further research to be explored. A full scale diffusion survey and analysis would provide a more reliable indicator of the rate of diffusion once the NAVWAN is deployed. A comprehensive cost and benefit analysis is also necessary to justify continued NAVWAN development and support. Once the prototype is completed, a detailed implementation plan to be used for deployment at other locations is also required.

A component of that implementation would include a standardized training plan for all NAVWAN users and also for system administrators. A large portion of the system administration responsibilities is security. Consequently, local and global security plans need to be developed. From the financial management perspective, the issue of enterprise

funding of information technology developments should be explored. Also, charge back schemes and outsourcing options for NAVAIR could be considered for further research.

D. SUMMARY

Assessment of NAVWAN implementation at NAS Miramar is indicative of the implications of NAVWAN implementation throughout NAVAIR. Analysis of these prototype implications is the basis for the aforementioned recommendations. These recommendations can be used to further refine the implementation process and foster evolutionary development of NAVWAN far into the future. As evidenced by the data gathered for the stakeholder analysis, people, money and organizational factors will be greater barriers to NAVWAN evolution than technology. However, incorporation of the critical and management recommendations in the NAVWAN implementation process will result in NAVWAN diffusion with enough momentum to overcome all barriers.

APPENDIX A. INTERVIEW QUESTIONS

1. Identification of the stakeholder
   a) What is the name of the command representative?
   b) What is the general mission of the command?
   c) What role does information technology play in accomplishing the command's mission?

2. What are the functional requirements of the stakeholder's information systems?
   a) Office Automation (word processing, file transfer)
   b) Communications (e-mail, message traffic, bulletin boards, Internet access)
   c) Decision Support Systems (spreadsheets, DBMS, SQL)
   d) Workstations (graphics, engineering drawings, project management)

3. To your knowledge, what are the current capabilities of the NAVWAN?

4. How does the NAVWAN's capabilities meet or facilitate achievement of your functional requirements?

5. Does use of the NAVWAN constrain the accomplishment of your functional requirements in any way? (For example, duplication of effort)

6. Will the NAVWAN facilitate interconnection of existing information systems with commands beyond the NAS? If so, what other commands and for what purpose?

7. What other benefits does the you expect to derive from interconnectivity with the NAVWAN? (For example, news groups and research information)

8. What is the anticipated response of the users at the site to the NAVWAN?
   a) Positive aspects? For example, increased knowledge and communication.
   b) Negative aspects? For example, information security.

9. Do the users at your site understand the capabilities of the NAVWAN?

10. What motivation exists for them to use it? Is it important for their job performance?

11. Will you provide training to the users on the capabilities of the NAVWAN?

12. Will interconnectivity of current and proposed systems with the NAVWAN increase the productivity of the users? If so, how is this accomplished?

13. Does it directly support the mission of the activity? Is it supported by the chain of command?

14. Are there any barriers to the NAVWAN implementation at this site?

15. How will you overcome these barriers?

APPENDIX B. DIFFUSION OF INNOVATION SURVEY

1. Rate the level of relative advantage of the NAVWAN to your current information systems.

LOW 1 2 3 4 5 HIGH

2. Rate the level of complexity of the NAVWAN for the average user.

LOW 1 2 3 4 5 HIGH

3. Rate the level of observability of the NAVWAN by potential users.

LOW 1 2 3 4 5 HIGH

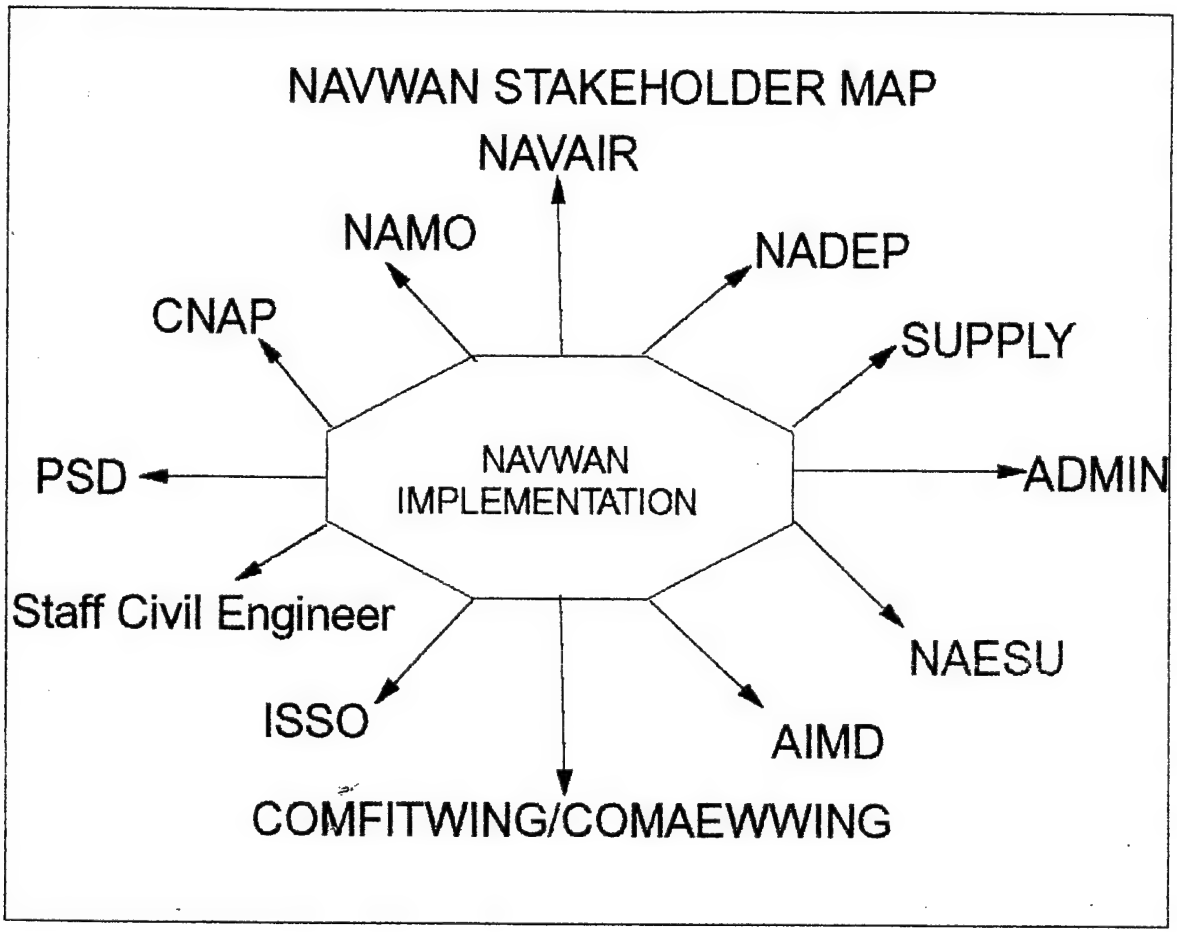
4. Rate the level of trialability of the NAVWAN by the average user.

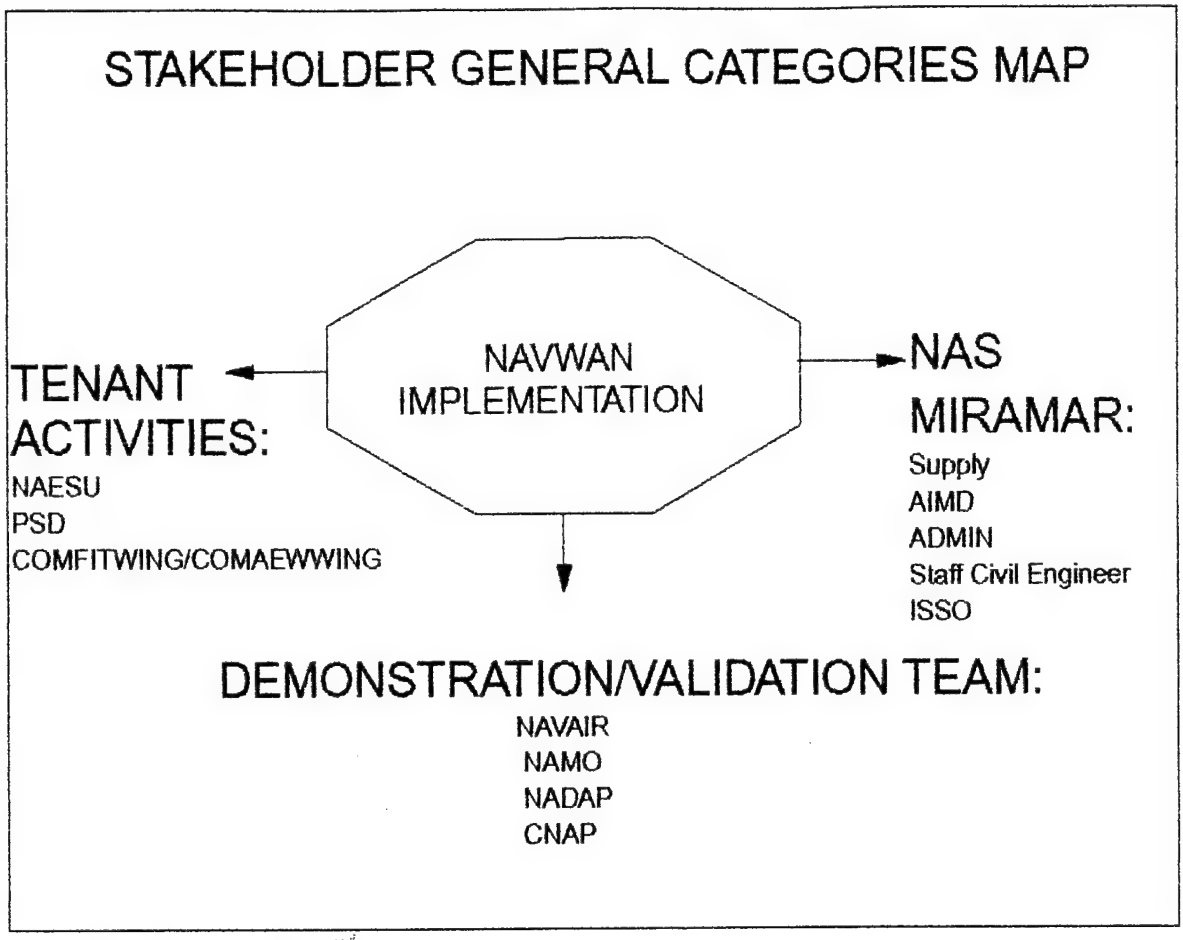
LOW 1 2 3 4 5 HIGH

5. Rate the level of compatibility of the NAVWAN with the average users current job.

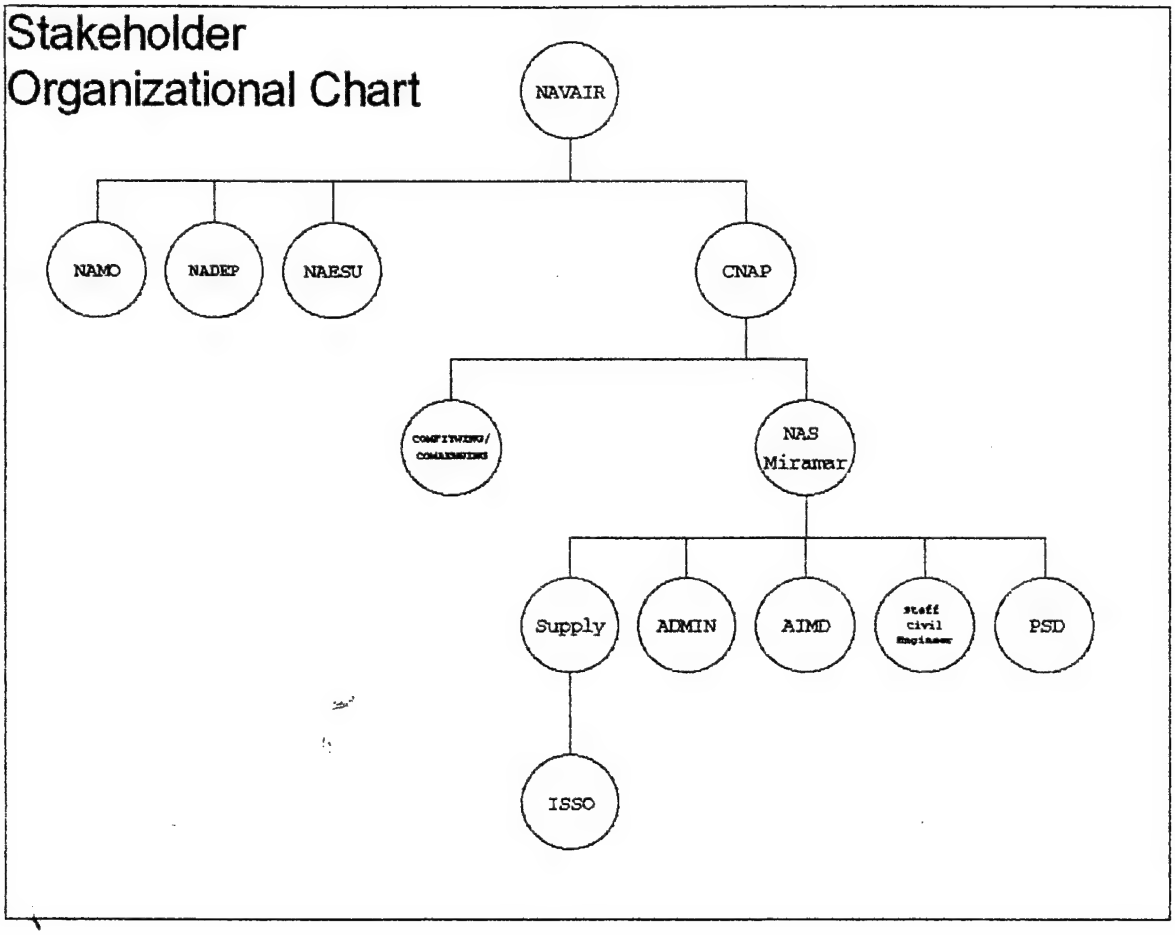
LOW 1 2 3 4 5 HIGH

APPENDIX C. STAKEHOLDER MAPS




STAKEHOLDER GENERAL CATEGORIES MAP
NAVWAN IMPLEMENTATION
TENANT ACTIVITIES:
NAESU
PSD
COMFITWING/COMAEWWING
NAS MIRAMAR:
Supply
AIMD
ADMIN
Staff Civil Engineer
ISSO
DEMONSTRATION/VALIDATION TEAM:
NAVAIR
NAMO
NADAP
CNAP

APPENDIX D. STAKEHOLDER ORGANIZATIONAL CHART



APPENDIX E. STAKEHOLDER AUDIT

1. Previous Knowledge Of NAVWAN Capabilities

NAVWAN Knowledge / Stakeholder	Yes	No
ISSO	yes	
COMFIT COMAEW	yes	
NAESU		no
Supply	yes	
NADEP	yes	
PSD		no
CNAP	yes	
AIMD	yes	
ADMIN	yes	
Staff Civil Engineer		no
NAVAIR	yes	
NAMO	yes	

2. Stakeholder Functional Requirements

Function / Stakeholder	Word process	FTP	Defense Message System	Bulletin Board Access	E-mail	Real Time Data Base Access	Spread Sheets	Graphics	Telecon-ference
ISSO	yes	yes	yes	yes	yes	yes			
COMFIT COMAEW	yes	yes	yes	yes	yes		yes	yes	
NAESU	yes	yes	yes	yes	yes	yes	yes	yes	yes
Supply	yes	yes	yes	yes	yes	yes	yes	yes	
NADEP	yes	yes	yes	yes	yes	yes	yes	yes	yes
PSD	yes	yes	yes	yes	yes	yes			
CNAP	yes	yes	yes	yes	yes	yes	yes	yes	
AIMD	yes	yes	yes	yes	yes	yes	yes	yes	yes
ADMIN	yes	yes	yes	yes	yes				
Staff Civil Engineer	yes	yes	yes		yes		yes	yes	
NAVAIR	yes	yes	yes	yes	yes	yes	yes	yes	yes
NAMO	yes	yes	yes	yes	yes	yes	yes	yes	yes

3. NAVWAN Interconnectivity

Interconnection / Stakeholder	NAVAIR	NALDA/ NAMO	NAVSUP/ ASO	BUPERS	CINCPAC	CNAP	MILNET	Internet
ISSO	yes	yes	yes	yes	yes	yes	yes	
COMFIT COMAEW	yes	yes	yes	yes	yes	yes	yes	
NAESU	yes	yes	yes	yes		yes	yes	yes
Supply	yes	yes	yes	yes	yes	yes	yes	
NADEP	yes	yes	yes	yes	yes	yes	yes	yes
PSD				yes	yes	yes	yes	
[illegible]	yes	yes	yes	yes	yes	yes	yes	
AIMD	yes	yes	yes	yes	yes	yes	yes	yes
ADMIN				yes	yes	yes	yes	
Staff Civil Engineer				yes	yes	yes	yes	yes
NAVAIR	yes	yes	yes	yes	yes	yes	yes	yes
NAMO	yes	yes	yes	yes	yes	yes	yes	yes

4. Benefits Of NAVWAN Interconnectivity

Benefit / Stakeholder	Reduced Costs	Faster Communi-cation	Internet Access	Reduced DMS Use	Standardiz ation	Time Savings	Improved Customer Service	Easy Access To Corporate Databases/ Improved Integrity
ISSO		yes		yes	yes	yes	yes	yes
COMFIT COMAEW	yes	yes	yes	yes	yes	yes	yes	yes
NAESU	yes	yes	yes	yes	yes	yes	yes	yes
Supply		yes	yes			yes	yes	yes
NADEP	yes	yes	yes		yes	yes	yes	yes
PSD		yes			yes	yes	yes	
CNAP		yes			yes	yes	yes	
AIMD		yes	yes	yes	yes	yes	yes	yes
ADMIN		yes		yes	yes	yes	yes	yes
Staff Civil Engineer		yes	yes	yes	yes	yes	yes	yes
NAVAIR	yes	yes	yes		yes	yes		yes
NAMO	yes	yes	yes		yes	yes		yes

5. Functional Requirement Constraints

Constraint / Stakeholder	Duplication Of Effort	No Internet Access	LAN Technical Limits	Resistance To Standardization	Limited Manpower Financial Resources To Develop/ Support	Only Unclas Info	Limited Access Due To Potential Abuse Of Authority
ISSO	yes				yes	yes	yes
COMFIT COMAEW	yes		yes		yes	yes	yes
NAESU	yes	yes	yes	yes			
Supply					yes	yes	
NADEP	yes	yes	yes	yes	yes		yes
PSD					yes	yes	
CNAP				yes	yes		
AIMD		yes		yes	yes	yes	yes
ADMIN	yes			yes	yes	yes	yes
Staff Civil Engineer		yes		yes	yes	yes	yes
NAVAIR		yes	yes	yes	yes		
NAMO	yes	yes	yes	yes	yes		

6. Barriers To Implementation

Barrier / Stakeholder	Future Funding	BRAC	Limited Quality Of IT Manpower	Limited Time To Implement	Politics Of Joint Effort	Resistance To Change From Existing Systems	Fear Of Abuse Of System	Information Overload	Internet Security Risks	False Expectation
ISSO	yes	yes	yes	yes	yes		yes	yes	yes	yes
COMFIT COMAEW	yes	yes	yes	yes	yes	yes	yes		yes	yes
NAESU		yes	yes			yes	yes	yes		yes
Supply	yes	yes	yes						yes	
NADEP	yes		yes		yes	yes	yes	yes		yes
PSD	yes								yes	yes
CNAP	yes	yes	yes	yes			yes			yes
AIMD		yes	yes		yes		yes		yes	
ADMIN		yes			yes		yes	yes	yes	
Staff Civil Engineer		yes			yes	yes	yes	yes	yes	
NAVAIR			yes	yes	yes	yes		yes		
NAMO			yes	yes	yes	yes				

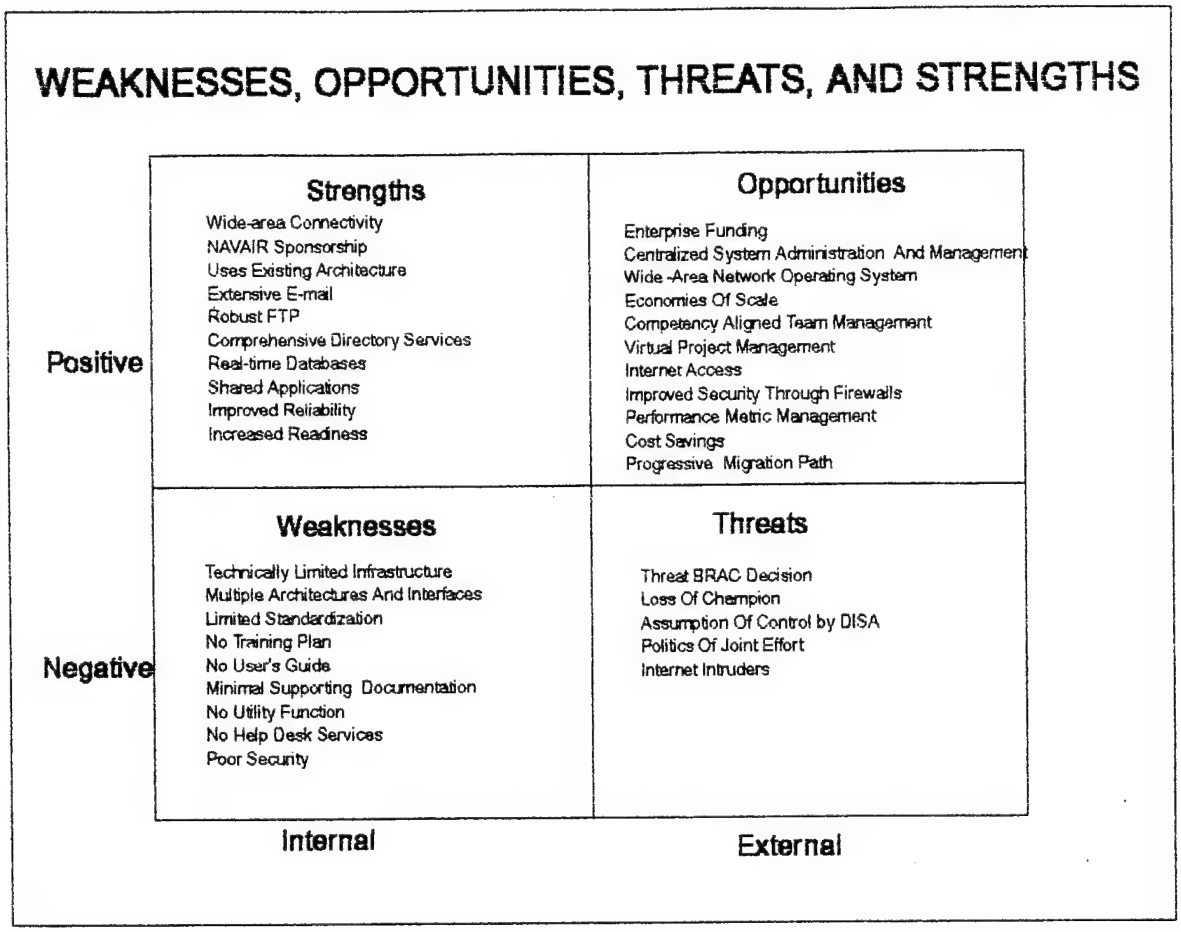
7. Methods To Overcome Barriers To Implementation

Method / Stakeholder	NAVAIR Corporate Funding	Combine Existing Communi-cation lines	Eliminate Other Systems	Centralize IT Personnel	Education/ Training	Establish Standards/ Configura-tion Mgt.	Establish Security Plan	Users' Positive NAVWAN Attitude Will Increase Diffusion
ISSO	yes	yes	yes	yes	yes	yes	yes	yes
COMFIT COMAEW	yes	yes	yes	yes	yes	yes	yes	yes
NAESU	yes		yes		yes	yes		
Supply	yes		yes		yes		yes	yes
NADEP	yes	yes	yes	yes	yes	yes	yes	yes
PSD			yes		yes		yes	yes
CNAP	yes	yes	yes	yes				yes
AIMD			yes		yes	yes	yes	yes
ADMIN			yes		yes	yes	yes	
Staff Civil Engineer			yes		yes	yes	yes	yes
NAVAIR	yes	yes	yes	yes	yes	yes	yes	yes
NAMO	yes	yes	yes	yes	yes	yes	yes	yes

8. NAVWAN Training

NAVWAN Training / Stakeholder	Provided By Command	Provided By Other Source	Combination Of Both	No Training	User Guides Required
ISSO	yes				yes
COMFIT COMAEW		yes			
NAESU	yes				
Supply	yes				
NADEP		yes			yes
PSD			yes		
CNAP				yes	yes
AIMD			yes		
ADMIN	yes				
Staff Civil Engineer		yes			
NAVAIR		yes			yes
NAMO		yes			

APPENDIX F. WEAKNESSES, OPPORTUNITIES, THREATS, AND STRENGTHS



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